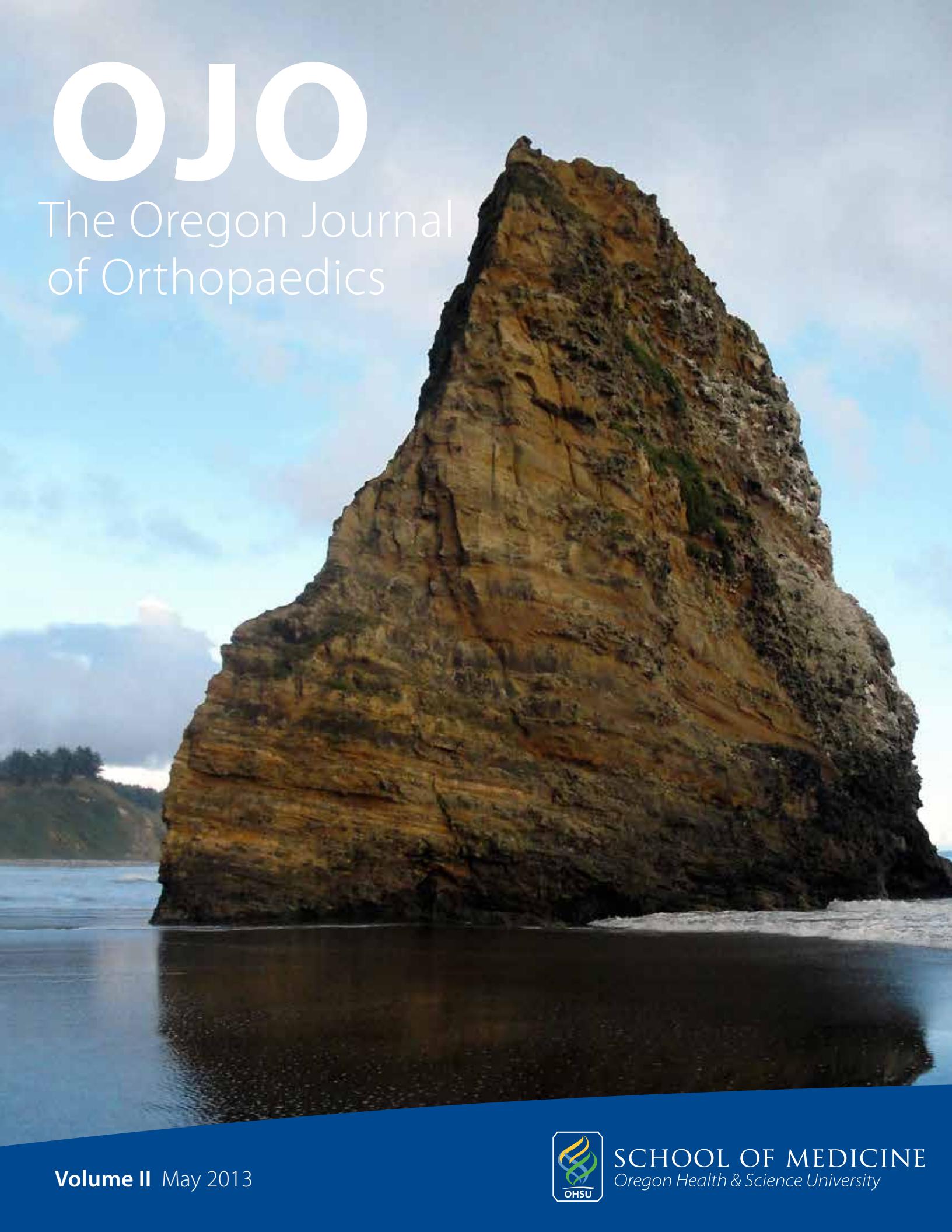


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Volume II May 2013



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Senior Editors: Alex DeHaan, MD, and John Seddon, MD

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



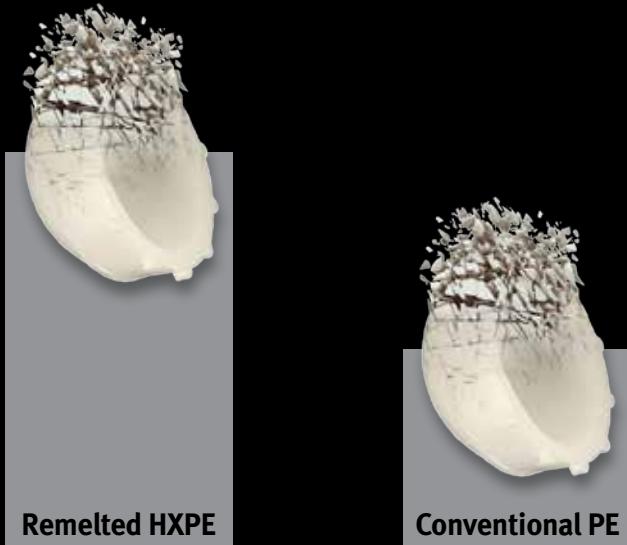
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Letter from the Editors

Welcome to volume two of *The Oregon Journal of Orthopaedics*. Thanks to the contributions from staff and residents, we feel that volume one was a great success. While it is our primary mission to highlight the research efforts and special interests of the OHSU Department of Orthopaedics & Rehabilitation, in moving forward, we hope to do an even better job of reaching out to our alumni, community orthopaedists and other health care providers across Oregon and beyond.

In this issue, our program director, Darin Friess, MD, comments in his editorial about our new partnership with Providence St. Vincent Medical Center and the Orthopedic + Fracture Specialist group. We feel that a strong point of our residency is our working relationship with entities outside of OHSU proper: the Portland VA Medical Center, Shriners Hospital for Children – Portland, Legacy Emanuel Medical Center and now Providence St. Vincent Medical Center. As of this writing, four fourth-year residents have had the opportunity to rotate at St. Vincent, and reviews have been nothing short of outstanding. We are very grateful for this new collaboration, and hope that it continues for years to come. This rotation has nicely complemented the time we get to spend at Legacy Emanuel Medical Center, working with Rich Gellman, Steve Madey, Britt Frome, Corey VandeZandschulp and Doug Beaman. From a resident's perspective, it is important to be able to see and learn a variety of surgical techniques and patient populations. Our Emanuel and St. Vincent rotations have allowed us to do just that. They also give us a glimpse into other health care models and practice set-ups.

Another new feature for this issue is commentary from the class of 2010. Adam Cabalo, MD, Gary Kegel, MD, Greg Byrd, MD, and Patrick Denard, MD, were our chiefs when we were interns and were residents we looked up to and learned a lot from. It is great to hear their perspectives on life outside of residency and fellowships, and to hear about how different their practices are at this point in their careers. We were lucky to work with them as interns, and wish them all the best.

Several changes have occurred within our department since volume one was printed. Jayme Hiratzka, MD, Class of 2012, has returned and joined the OHSU faculty this past fall after completing a fellowship in spine surgery at the University of Utah. Michael Kennedy, MD, our foot and ankle specialist, has left and joined a practice in Wisconsin. To take his place, James Meeker, MD, will be joining the OHSU faculty in October 2013, having completed a foot and ankle surgery fellowship at Harborview in Seattle, WA, in 2012; he is currently doing an additional fellowship in trauma surgery in Los Angeles at Cedars-Sinai Medical Center.

Finally, this is the perfect opportunity to wish our current chief class, comprising Drs. Baker, Kuhne, Matsen Ko, Munch and Wiekking, all the best. All five of them are pursuing additional training in a wide range of fellowship specialties across the United States and abroad. We are sure they all will be successful in whatever they put their minds to. Good luck Class of 2013 – it's been great working with you.

The Editors

Faculty Editor: Amer Mirza, MD

Editor Emeriti: Rich Myers, MD, and Brent Roster, MD

Senior Editors: Alex DeHaan, MD, and John Seddon, MD

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

Letter from the Chair



Dear Alumni and Friends,

There is no question that we exist in a world of change, especially in the realm of health care. However, current changes in health care seem less about the science of medicine than about the economics of health care delivery. Amidst the cacophony surrounding the future of health care, it is easy to become bewildered, apathetic or even discouraged. Does anyone understand the meaning of acronyms such as PCMH, PQRI, VBP, CCO, P4P, CAQH, HIE, EMR and ASO? The myriad new acronyms and phrases strewn throughout health care discussions make the ideas seem familiar to some, but foreign to those who actually deliver care.

Like most that are in the front line of medicine, I am often confused about these issues, but I am not discouraged. Despite the storm of change, I witness those who continue to be successful. What I observe in these individuals is always the same: they have never abandoned the core reasons for this chosen profession. Nothing has fundamentally changed about the physician-patient relationship as defined by the Hippocratic oath as it was spoken two and a half millennia ago.

I see medical students, residents and young faculty continue to make their way into the orthopaedic world. They discover the wonders of what this profession offers: discoveries, innovations and daily opportunities to make a meaningful difference in our patient's lives. They keep me engaged and invigorated. One of the greatest gifts that I have received in my life is being surrounded by young and dedicated physicians who will continue to serve and honor our profession.

Sincerely,

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

Letter from the Program Director



The Orthopaedics Residency Program at OHSU continues to push ahead with new educational changes each year. The biggest change for the 2012-2013 year has been starting a new PGY4 rotation at Providence St. Vincent Medical Center and with Portland's Orthopedic + Fracture Specialists group. The purpose of the rotation is to expose the residents to a typical community hospital practice, both in business and case mixture. It has been an exciting time for both the staff physicians new to working with residents and for the first few residents spending time on this rotation. Residents have been doing more joint arthroplasty, sports medicine and other outpatient cases based upon their interest. Early reviews from staff and residents have been very positive. We look forward to this continued collaboration with the Providence St. Vincent Medical Center and Orthopedic + Fracture Specialists for years to come. Thank you to all the physicians and administrators who have made this educational innovation possible.

The next 2013-2014 academic year will bring further changes to our residency program as well. The last major innovation in residency programs was the onset of the 80-hour work restrictions several years ago. Now, nationwide, all residency programs are embarking on the "Next Accreditation System (NAS)." It represents a fundamental change in how all medical residencies, including orthopaedics, are reviewed and accredited. The biggest component of this change is the advent of 16 new "Milestones," which are designed to assess the competency of each resident to provide a spectrum of care for standard musculoskeletal problems such as ACL injury, carpal tunnel syndrome, degenerative spine disease and other common problems. All orthopaedic residents nationwide will be evaluated on the same scale. This is a great chance for each program to reassess its curriculum and evaluation system.

Finally, the 2013-2014 year will bring big changes to the PGY-1 intern year at the request of the American Board of Orthopaedic Surgery (ABOS). Orthopaedics will be splitting further away from the standard general surgery intern year that many recall fondly. Interns will be required to spend six months on orthopaedic services, with dwindling time on other rotations. While a month of plastics, vascular and general surgery will remain, we are losing month-long rotations in neurosurgery, radiology and anesthesiology. Although the chance to spend more time educating our residents is exciting, we do have some regrets over the further split with our wonderful surgical colleagues here at OHSU. We will be working in other ways to maintain the collegial working relationship we have developed through the years. A further minor change mandated by the ABOS is the requirement that all interns undergo a structured surgical skills simulation program. The exact requirements of the program are still pending at press time, but we are in the process of building a skills program to be proud of. Simulation is a hot topic both here at OHSU and at any nationwide conference. OHSU is building a new skills simulation lab as part of the ongoing construction of the OUS/OHSU Collaborative Life Sciences Building at Portland's South Waterfront to open in 2014. We hope to be using this facility in years to come.

As we see the practice of orthopaedics change over the years, we must remember that a solid education of basic anatomy, science and surgical skills provides the foundation for a surgeon to grow. Thanks to many of you readers for your assistance in the education of young surgeons. And if you want to get involved further with education, surgical simulation or simply an occasional Grand Rounds topic, please let us know. Contact our department at 503 494-6400.

Sincerely,

Darin Friess, MD

Residency Program Director and Assistant Professor, OHSU Department of Orthopaedics & Rehabilitation



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By supporting the Department of Orthopaedics & Rehabilitation at OHSU, you can make a significant impact on our ability to train the next generation of specialists, advance patient care, and develop new knowledge through research. We are building on a legacy of excellence that spans from Richard Dillehunt, MD, and Leo Lucas, MD, to Lawrence Noall, MD, and Rodney Beals, MD, to the current leadership under Jung Yoo, MD. Your personal gift is a vital part of this legacy and our future.

Please make your gift to the Department of Orthopaedics & Rehabilitation at OHSU by donating to one or more of the fund areas listed below. Each fund provides crucial and strategic resources for our education, training and research missions.

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[Lawrence Noall, M.D., Fund for Excellence in Orthopaedic Resident Education](#)

Gifts to this fund support resident education in the Department of Orthopaedics & Rehabilitation.

[Orthopaedic Research Endowment](#)

This endowment provides essential support for basic science research in the field of Orthopaedics.

[OHSU Department of Orthopaedics & Rehabilitation Support](#)

Gifts to this fund support the Department broadly, and are often used to address unanticipated needs or provide support for strategic priorities.

Please contact us if you would like to explore establishing a fund of your own, or if you wish to include OHSU Orthopaedics & Rehabilitation in your estate plans.

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Directory 2012–2013

Oregon Health & Science University (OHSU)

Adult Reconstruction



Kathryn Schabel, MD



Thomas Huff, MD

Foot & Ankle



Michael Kennedy, MD

Directory 2012–2013

Oregon Health & Science University (OHSU)

General Orthopaedics



Alex Herzberg, MD

Infectious Disease



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

Pediatrics



Matthew Halsey, MD

Directory 2012–2013

Oregon Health & Science University (OHSU)

Physical Medicine & Rehabilitation



Hans Carlson, MD



Nels Carlson, MD

Podiatry



Trish Ann Marie Otto, DPM

Directory 2012–2013

Oregon Health & Science University (OHSU)

Research / Basic Science



Jamie Fitzgerald, PhD



Brian Johnstone, PhD



Lynn Marshall, ScD

Spine



Alex Ching, MD



Robert Hart, MD



Jung Yoo, MD



Jayme Hiratzka, MD

Directory 2012–2013

Oregon Health & Science University (OHSU)

Sports Medicine (Primary Care)



James Chesnutt, MD



Melissa Novak, DO



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



Charles Webb, DO
Program Director,
Sports Medicine Fellowship



Rachel Bengtzen, MD

Directory 2012–2013

Oregon Health & Science University (OHSU)

Sports Medicine (Surgical)



Dennis Crawford, MD, PhD



Andrea Herzka, MD

Trauma



Darin Friess, MD
Director, Residency Program



Amer Mirza, MD

Directory 2012-2013

Oregon Health & Science University (OHSU)

Bone and Soft Tissue Tumors



Yee-Cheen Doung, MD

Assistant Director
Residency Program



James Hayden, MD, PhD

Upper Extremity



Adam Mirarchi, MD

Co-Director of OHSU
Hand Fellowship



Robert Orfaly, MD

Directory 2012–2013

Portland VA Medical Center



Jesse McCarron, MD

Chief of VA Orthopaedics



Ted Vigeland, MD

Directory 2012–2013

Shriners Hospital for Children – Portland



Michael Aiona, MD
Chief of Staff, Program Director



Jeremy Bauer, MD



Charles d'Amato, MD
Director, Spinal Deformity



J. Krajbich, MD, FRCS(C)



Ellen Raney, MD



Dennis Roy, MD
Director, Education



Michael Sussman, MD

Directory 2012-2013

Legacy Emanuel Medical Center



Doug Beaman, MD

Foot & Ankle Specialist



Britton Frome, MD

Hand / Upper Extremity Specialist



Richard Gellman, MD

Orthopaedic Traumatologist
Foot & Ankle Specialist



Steve Madey, MD

Hand / Upper Extremity Specialist



Corey Vande Zandschulp, MD

Orthopaedic Traumatologist

Directory 2012–2013

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

Directory 2012–2013

Orthopedic + Fracture Specialists



Edward Lairson, MD



Hans Moller III, MD



Rosalyn Montgomery, MD



Linda Okereke, MD



Rolf Sohlberg, MD



Venessa Stas, MD



Robert Tennant, MD

Directory 2012-2013

Kaiser Permanente



Stephen Renwick, MD



Ronald Turker, MD

Directory 2012–2013

Fellows

Sports Medicine, Primary Care



Jon Kolberg, MD



Breanne Brown, DO

Spine

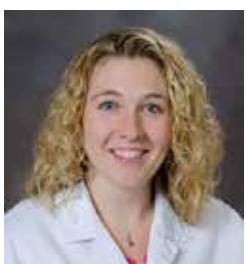


Max Berdichevsky, MD



Marc Najjar, MD

Hand



Melissa Kinder, MD

Directory 2012–2013

Residents

PGY-5 Class



Adam Baker, MD

Hometown: Arkansas City, KS

Medical School: University of Missouri-Columbia

Fellowship Plans: Foot and Ankle, Campbell Clinic; Memphis, TN



Michael Kuhne, MD

Hometown: Plainview, NY

Medical School: The George Washington University School of Medicine & Health Sciences

Fellowship Plans: University of California, San Francisco Trauma Fellowship; San Francisco, CA



Laura Matsen-Ko, MD

Hometown: Seattle, WA

Medical School: Oregon Health & Science University

Fellowship Plans: Adult Reconstruction Fellowship with Dr. Paul Duwelius; Portland, OR



Jackie Munch, MD

Hometown: Las Vegas, NV

Medical School: University of Michigan Medical School

Fellowship Plans: Sports Medicine, Hospital for Special Surgery; New York City, NY



Dan Wierking, MD

Hometown: Walnut Creek, CA

Medical School: University of California, San Diego

Fellowship Plans: Foot & Ankle Fellowship, Melbourne Orthopaedic Group; Melbourne, Australia

Directory 2012–2013

Residents

PGY-4 Class

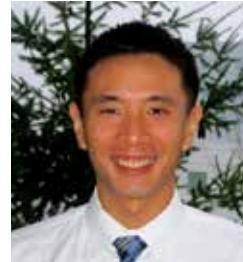


Zach Domont, MD

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

Directory 2012–2013

Residents

PGY-3 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: Broad interest, Undecided



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: Undecided



John Seddon, MD

Hometown: Eugene, OR
Medical School: Saint Louis University School of Medicine
Fellowship Plans: Undecided

Directory 2012–2013

Residents

PGY-2 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: Undecided



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: Undecided



Farbod Rastegar, MD

Hometown: San Diego, CA

Medical School: University of Chicago,

The Pritzker School of Medicine

Fellowship Plans: Undecided

Directory 2012–2013

Residents

PGY-1 Class



John Cox, MD

Hometown: Gallup, NM
Medical School: University of New Mexico
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
Fellowship Plans: Undecided



Ryan Wallenberg, MD

Hometown: Medford, OR
Medical School: Creighton University
Fellowship Plans: Undecided

Alumni Profile

"Volunteerism at Its Finest" Our Local Community: David Shaw, MD, Class of 1978

By Alex DeHaan, MD, and Brent Roster, MD

Born in 1940, David Shaw, MD, grew up in Lucknow, India, where he obtained a Bachelor of Science degree from Lucknow University at the age of 17. His pursuit of medicine began one year later at Christian Medical College: Ludhiana, in Punjab, India. He then sought further training in orthopaedics, during which time he married his wife Rita in 1965. After achieving his master's degree in orthopaedic surgery in 1968, he moved to Bareilly, India, where he was responsible for an 80-bed orthopaedic unit at Clara Swain Hospital. He was extremely busy, as he was the only orthopaedist providing coverage to nearly 1.5 million people. At the time, approximately one-third of his work was treating bone and joint tuberculosis, one-third treating polio and one-third providing more general orthopaedic care involving mainly adult trauma, pediatric deformity and cerebral palsy. He had a research grant that helped treat spinal tuberculosis, where he routinely did an anterolateral decompression and fusion, using a rib as a strut graft for an interbody fusion.

After two years of practice, he was recruited to care for children at Fairview Hospital in Salem, OR. He met a friend leading an orthotics and prosthetics missionary workshop in India, who convinced him to come to Oregon, reporting a great need for Dr. Shaw's expertise and experience in treating patients with cerebral palsy and other pediatric conditions. After three years in Salem, Dr. Shaw returned to India to teach at his prior university, Christian Medical College: Ludhiana, for several years. However, during his time in Salem, he had formed a professional relationship with William Snell, MD, who at that time was the chair of the orthopaedic department at the University of Oregon Medical School (now OHSU). A residency position had opened in the program, and Dr. Snell

contacted Dr. Shaw in India and offered him the position to further his training. Dr. Shaw completed his residency in 1978, and entered a private practice as a general orthopaedist in Salem. His practice encompassed all aspects of orthopaedics, including trauma, pediatrics, adult reconstruction and spine.

During his professional career, Dr. Shaw has developed a unique perspective on orthopaedics and medicine through nearly two decades of overseas missionary work. He first became involved in 1995, when asked by a church group if he would be interested in going to Africa to help deliver orthopaedic care to those in need. He subsequently took four trips to West Africa between 1995 and 1998: two to Guinea and two to Togo. While in Africa, the missionary teams provided health care for all patients who needed treatment, which were primarily cases of orthopaedic trauma or post-traumatic nonunions and malunions. Since 1999, he has transitioned his volunteer efforts to South America.

Dr. Shaw was able to form a team of volunteer health care providers that take two trips a year, one to Ecuador and one to Peru. They have gone to various locations within these two countries, and specifically treat pediatric patients in need of orthopaedic care. The missions are typically for two weeks each, and consist of a team of 20-30 people including orthopaedists, anesthesiologists and numerous nurses, physical therapists, and orthotists. Occasionally, other specialties (such as urology, ENT, etc.) are recruited to join and provide care as well. The team brings all of their own health care supplies on these trips in the form of checked luggage. Different volunteers within the group spend the majority of the year saving unused medical equipment, which is then re-packed and sterilized prior to the trip. It is typical for the team to

(continued)

see between 200 and 300 clinic patients and perform 40 or more surgeries during their time abroad.

Dr. Shaw reports that he and his team especially enjoy taking care of children, as they have the most to benefit from this care. The health care systems in Ecuador and Peru allot the majority of health care money to emergencies and trauma cases, not pediatric reconstruction, deformity and developmental problems. As a result, these problems go untreated for years and become increasingly symptomatic and debilitating. The team views these as complex but treatable problems, and they commonly treat clubfeet, Blount's disease, malunion or nonunion of various fractures, chronic untreated osteomyelitis or septic arthritis, developmental hip dysplasia and even a variety of tumors. All of their fracture and reconstructive work is done without the use of fluoroscopy. In cases of DDH (five on the most recent trip alone), the femoral and acetabular osteotomies are performed based on their surgical experience, knowledge of anatomy and intra-operative decision-making. Oftentimes, complex cases are done early in the trip, such that cast and dressing changes can be done prior to the team's departure. A local orthopaedist helps with the majority of follow-up care and can ask Dr. Shaw any questions he has via email.

This past January 2013, the team went to Machala, Ecuador. Accompanying Dr. Shaw and the team was OHSU orthopaedic faculty member Ted Vigeland, MD, who has now been on four missions with the group. After accounting for travel



Dr. David Shaw with two patients

Pictured (left to right): Dr. Ted Ragsdale (ortho), Dr. Ted Vigeland (ortho, OHSU faculty), Dr. Mel Wade (anesthesia), Dr. David Shaw



time, the team spent a total of five days treating patients. During this time, they estimated seeing nearly 200 patients in clinic and performed 62 procedures in 29 children. Many of the non-surgical patients were managed with casting and various bracing treatments for their pathology (23 AFOs, one above-knee and one below-knee prosthesis, five hip braces and multiple walkers and crutches). Overall, the team felt was very pleased with the care they were able to provide and are beginning to gather supplies for their next trip later this year.

Dr. Shaw is currently practicing in Salem, with his practice focused primarily on adult hip and knee reconstruction, sports medicine and arthroscopy, a multitude of pediatric conditions and diabetic lower extremity problems.

When reflecting on his missionary work, Dr. Shaw acknowledges the huge need around the world for this type of medical care. Orthopaedists, nurses and health care providers in all specialties and levels of training have something to offer. There is great opportunity to really help people and change not only the life of a patient, but your own life as well.

Example of Clinical Cases seen in Machala, Ecuador - January 2013



Severe Clubfoot Deformity



Sequelae of Untreated Right Hip Septic Arthritis



Right Hip Dislocation in setting of DDH



Right Leg PFFD (proximal femoral focal deficiency)

Perspective

The Economic Value of Orthopaedic Surgery

By John Tongue, MD, 2012 President, American Academy of Orthopaedic Surgeons (AAOS)



Against the backdrop of large budget deficits and a slow economy, increasing health care costs are receiving unprecedented scrutiny from policymakers and payers seeking to obtain greater value

from the U.S. health care system. An increased focus on value is not a bad thing, of course. But more often than not, this attention is focused only on costs of health care services and procedures with little consideration of the long-term outcomes or benefits. The high cost to payers and patients of musculoskeletal (MSK) procedures, from the narrow focus on the direct costs, poses a significant threat to access for patient care during health care reform's focus on cost. Payers may limit patients' access to these services and may reduce reimbursements to providers for these services. Some insurers are using value-based pricing to influence patient behavior by covering a higher proportion of medical costs for services with a perceived higher demonstrated value. Policymakers are also focusing on value as evidenced by the Affordable Care Act of 2010, which contains several provisions aimed at increasing the return on health care expenditures.

To counteract this threat to orthopaedic surgical care, we must be able to demonstrate the economic value of our services to policymakers, payers and patients. The AAOS commissioned KNG Health Consulting, LLC (KNG Health) and its partner, IHS Global Insight, to examine the societal and economic value of MSK care for a broad range of

conditions and treatments. The KNG Health team has developed a model for valuing musculoskeletal care and applied the model to estimate the value of treatments for five conditions: end-stage osteoarthritis of the knee, hip fracture, disc herniation, rotator cuff tears and anterior cruciate ligament tears.

Societal and Economic Value Defined

The KNG Health team estimated the value of MSK treatment through cost-effectiveness analysis, a type of economic valuation that examines the costs and health outcomes associated with alternative intervention strategies. Improvement in patient health outcomes is measured by changes in the Quality-Adjusted Life Year (QALY) as a result of a surgical intervention. The QALY is based on the number of years of life that would be added by an intervention. Each year in perfect health is assigned the value of 1. If the extra years would not be lived in full health – for example if the patient would be wheelchair-bound after the medical intervention – then the extra life-years are given a value between 0 and 1. Death is valued at 0. Surgical treatment may increase QALYs without increasing the length of life, if the treatment improves a patient's quality of life without changing life expectancy.

In examining the costs associated with alternative interventions, the study examined both direct medical costs and indirect costs, which reflect a societal perspective that includes the costs to patients, third-party payers (i.e., insurers), employers and governments. Patients who are unable to work may suffer loss in incomes, while employers bear the costs associated with higher absenteeism and lower productivity. Third-party payers see increased costs to cover medical care, while governments may incur costs to patients who

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qualify for Supplement Security Income payments and Medicaid as a result of their MSK conditions.

Value (i.e., net benefits to society) is defined as the difference between outcomes when surgical treatment is provided as compared to what societal outcomes would have been if only non-surgical treatment was provided. Net benefits to society are estimated as the difference in indirect costs associated with surgical and non-surgical treatments minus the additional direct medical costs associated with surgery. For example, let's assume a patient's lost wages were \$1,000 with surgery (due to time off from work for surgery) and would be \$2,000 without surgery (due to decreased ability to work because of an MSK condition). If surgery increased the patient's direct medical costs by \$500, then net benefits to society from surgery would be \$500 (reduced lost wages of \$1,000 offset by higher direct medical costs of \$500).

Cost-effectiveness is expressed as an incremental cost-effectiveness ratio, where the denominator is a gain in health status from an intervention (i.e., the number of QALYs) and the numerator is the direct cost associated with the health outcome. Interventions are typically considered cost effective if an additional QALY can be gained for \$50,000 or less in additional direct medical costs, which include medical costs for the select MSK condition and associated treatments, including treatments that result from any surgical complications.

Findings

The preliminary study findings demonstrate that treatment for the five selected conditions is highly cost effective. For all of the conditions studied, the benefits to society, largely derived from greater earnings and reduced nursing home costs, more than offset the additional direct medical costs.

For treatment of osteoarthritis of the knee, for example, total knee arthroplasty (TKA) increases lifetime direct costs by an average of \$20,704 (2009 dollars). These costs are offset by societal savings from reduced indirect costs equal to \$40,632, resulting in lifetime societal net benefit

per patient from TKA of \$19,928. Eighty-five percent of these savings originate from increased earnings, while the remaining 15 percent comes from fewer missed worked days and lower disability payments.

For displaced intra-capsular hip fractures, the surgical treatment costs \$19,710 more than non-surgical treatment, which is offset by savings of \$527 from lower long-term medical cost and \$78,295 from reduced nursing home use. Similarly, for extracapsular hip fractures, the direct medical costs for surgical treatment are \$22,317 higher than that of non-surgical treatment. However, savings of \$1,748 from lower long-term medical costs and \$82,365 from reduced nursing home use offset the extra direct medical costs and yield average net savings of \$61,699.

With the growing emphasis on increasing the value of the U.S. health care system, these findings support the view that the selected orthopaedic surgical procedures provide tremendous value, given their impact on patients and society at large.

Perspective

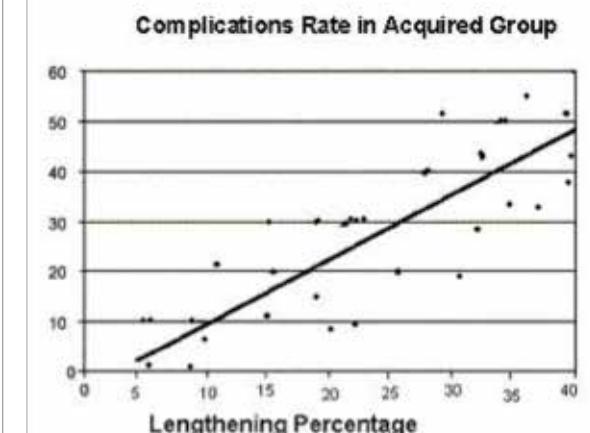
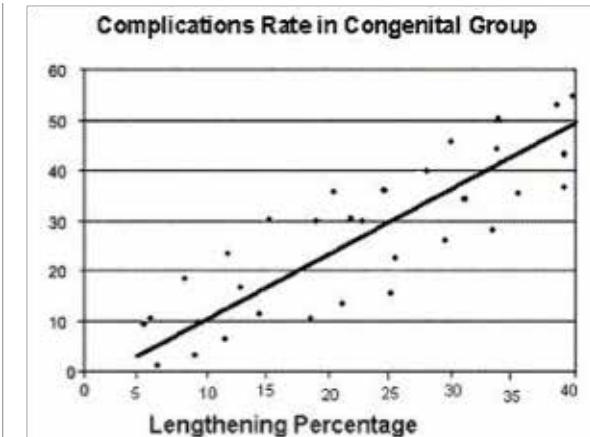
Management of Pediatric Lower Extremity Deformities

By Ellen Raney, MD, Shriners Hospital for Children – Portland



The nearest healthcare facility is often a boat ride away. Hospitals with surgical services and an array of parenteral antibiotics may take days or weeks to reach. The children from many underserved areas of the Pacific Basin face these conditions. From my previous base at the Shriners Hospital in Honolulu, Hawaii, I saw many cases of deformity resulting from untreated or inadequately treated infection and trauma. Milder deformities with a remaining healthy growth plate may be treated with guided growth through hemi-epiphysiodesis, which has enjoyed a recent resurgence as hardware has improved. The figure of 8 plates span one side of the physis, creating a tension band that allows the differential growth and progressive correction.

Unfortunately, children often present with more severe or complex deformities requiring distraction osteogenesis with external fixation. Such children do surprisingly well with their frames, although the rate of complications remains high.



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Common complications of deformity correction with distraction osteogenesis include stiffness, joint subluxation, pin tract infection, nerve damage, and pain. Strategies are implemented to avoid specific complications. Stiffness is minimized by careful consideration of cross-sectional anatomy during pin placement to minimize soft tissue impingement, aggressive rehabilitation, and dynamic splinting. Joint stability is primarily protected by limiting distraction in the presence of contractures; other considerations are protective orthoses and, if needed, spanning the joint with the external fixation. Pin tract infections may be minimized by the use of meticulous insertion technique and the use of hydroxyapatite-coated pins to decrease loosening and improve skin care. Careful pin placement avoids acute nerve damage. Patients should be frequently examined during the lengthening process for the development of neurapraxias, which may require surgical release. Avoiding contractures, subluxation and stiffness helps decrease pain. There is some evidence that the use of botulinum toxin A to relax the muscles undergoing lengthening is associated with decreased narcotic usage.¹

Children who come to Shriners Hospitals often return to underserved areas lacking in orthotic and prosthetic services. Treatment plans need to include maximizing their ability to function in the environment to which they will return. Often this means more aggressive treatment of limb length inequality. Such corrections often have an even higher complication rate.

Experience with these children supports the anecdotal evidence that children with normally developing limbs have a lower complication rate during limb lengthening than those with underlying congenital abnormalities. To determine whether this difference was real or apparent, we reviewed 88 lower extremity-lengthening/deformity-correction patients divided into two groups, acquired vs. congenital deformities. The groups were similar in terms of age, tibia vs. femur, and level of osteotomy. The analysis revealed a significant correlation between percent length gained and complications encountered. There were slightly more complications in the congenital group but the difference was not significant.²

At the Shriners Hospital here in Portland, we see deformity from infection and trauma, but more commonly the deformities are secondary to skeletal dysplasia or congenital abnormalities such as proximal femoral focal deficiency or fibular hemimelia. Congenital and dysplastic deformities are still treated with guided growth if possible. Distraction osteogenesis is reserved for the more severe cases. The research performed in Hawaii still pertains: Expect increased complications with higher percentage lengthening. I recommend considering the lengthening be divided into separate stages for deficiencies greater than 20% of the current bone length. One needs to consider what the discrepancy will be at the end of growth.

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Perspective

The New Orthopaedic Residency Program at Good Samaritan Regional Medical Center

By Luis Vela, DO, Director of Medical Education and Program Director of Orthopedics, Good Samaritan Regional Medical Center

Years ago, Samaritan Health Services President/CEO Larry Mullins, DHA, envisioned community-based medical education programs to offset physician shortages in the mid-Willamette Valley. In collaboration with others, Samaritan Health Services began medical clerkships in 2007, residency programs in 2009 and the opening of a new health sciences campus, home to medical school COMP-Northwest, in 2011.

The orthopedic residency program is based in Corvallis at Good Samaritan Regional Medical Center, the largest tertiary care hospital with Samaritan Health Services. The orthopedic residency program began with three residents in 2010, currently has nine residents, and when fully mature will have a total of 15 residents (three per year).

Our faculty includes orthopedic surgeons from within the Samaritan system, as well as those in independent practice, including several from The Corvallis Clinic. Many faculty members are fellowship trained in various subspecialties, including joint reconstruction, foot and ankle, hand and upper extremity, sports medicine and trauma. Some subspecialty rotation needs have been addressed by collaborating with organizations outside of Samaritan Health Services to enhance experience and education.

During their training, residents have rotations at Shriners Hospital for Children – Portland in pediatrics and OHSU for orthopaedic oncology. In addition to these rotations, residents attend courses including AO Trauma and Enneking for MSK Oncology, and also participate in arthroscopy skills lab, sponsored by Arthrex, twice a year in Tracy, CA. These cadaveric courses, as well as our new dry lab, ensure opportunities for our residents to become more proficient in their skills.

Academic half-days are held every Friday morning and include x-ray and fracture review, CORE lectures,

OITE review and casting clinics as well as cadaveric experiences at COMP NW. The residents have a unique opportunity to work collaboratively with athletic training students and PAC-12 athletes at nearby Oregon State University, spending time in the training room and at athletic events.

It has been exciting to be a part of the development of a community-based graduate medical education program that includes not only orthopedics but also general surgery, family medicine, internal medicine, psychiatry and cardiology. Our mission is to create a legacy of quality physicians and lifelong learners through a rigorous academic program integrated with clinical practice. We look forward to continuing the development of our program in the mid-Willamette Valley and to working with our partners to strengthen orthopedic education in Oregon.

Perspective

Reflections on the Orthopaedic Research Society – a Q& A with Brian Johnstone, PhD

By Alex DeHaan, MD



Brian Johnstone, PhD, the research director for the department, recently finished a seven-year term serving in the leadership of the Orthopaedic Research Society (ORS). Initially conceived 59 years ago as

an organization that would arrange a scientific meeting in the United States each year, the ORS has grown into the leading musculoskeletal research society in the world. Its mission is to advance the global orthopaedic research agenda through excellence in research, education, collaboration, communication and advocacy. In a recent interview, Dr. Johnstone talked about his experience during the past seven years.

What precipitated your involvement with the leadership of the Orthopaedic Research Society?

I had been an active member of the society for many years and served on various committees. I had no desire for higher office but when I was asked to consider running for the presidential line I recalled a conversation with my postdoctoral mentor, Bruce Caterson, PhD, just a few years earlier. He noted that his generation was getting older, and it was time for younger mid-career scientists to step up and run the show – making the point that we owe it to those that had come before us to preserve the organizations that provide beneficial activities for the musculoskeletal research community. With those words in mind, I agreed to stand. I felt it was my turn to give back to the society which had provided so much for me as a younger scientist.

What was the major issue of your time in leadership?

My first board meeting was an eye-opener. The board was preoccupied with a major dilemma – it was a victim of its own success. Membership had grown to over 2,000, and the annual meeting had close to 3,000 attendees from all over the world and was growing each year. Since its inception, the annual meeting had always been run in the same city and right before the annual meeting of the American Academy of Orthopaedic Surgeons (AAOS). This is a unique conjunction and one considered advantageous for both societies. However, the growth in the ORS had forced it out of hotel meeting spaces and into the convention centers where the AAOS met. Since the AAOS meeting has about 30,000 attendees, the ORS was now struggling to create a presence for its attendees, always compromising on space, hotel rooms, etc. There were lots of ideas for expanding the ORS so that it could offer more things that its members wanted, but the logistical and financial constraints of meeting with the AAOS were huge. After experimenting with several solutions, including meeting in separate cities from the AAOS, it looks like we have found a working compromise; aided by the expansion of hotels to be able to accommodate meetings of 3,000 or more, and moving the meeting to overlap with the AAOS at the end rather than at the beginning of its meeting.

How was your presidential year?

In my first years on the board, the problem of the annual meeting dominated everything. Once the ORS decided on a plan to experiment and find the right solution, the board was able to become the strategic body it should be. Luckily, by the time I assumed the presidency, we had a new strategic

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plan and many exciting ideas that we wanted to try. I spent my year streamlining the society structure to fit the plan. Given the economic outlook and the terrible state of scientific funding that threatens our field, we had to carefully craft the way forward. However, despite the constraints, the society has become outward-looking and ready to act as the leading global orthopaedic society that it was, but had not properly recognized.

Did your position at OHSU play any part in your role with the ORS?

As I assumed the presidency for the 2011-12 year, Dan Berry, MD, and John Tongue, MD, became AAOS president and first vice president, respectively. Dan was born in Oregon and still has family here. John has a practice in Portland and a joint appointment with our department. Although I was born in England and gradually migrated to the Pacific Northwest over 25 years, my eight years in Portland were enough to give us a personal connection that facilitated excellent communication between the two societies. It was great to be part of Oregon's leadership of the two most important entities in orthopaedics.

What did you learn from your time spent in leadership?

The ORS is unique in that it is run by biologists, engineers, and clinicians working together. The leadership has an equal representation of all three disciplines. It was fascinating to learn how differently these three types of scientists view issues. At times, it felt like herding cats, but it was also tremendous fun to take the differing views and find a compromise that suited all.

I would like to add that I could not have done it without the fantastic support of my family and my laboratory staff, who tolerated my frequent absences. I will be forever grateful for all the great advice and encouragement given by Dr. Yoo and my colleagues in the department.

Resident Perspective

The Oregon Trauma System: 25 Years of Saving Lives (1988–2013)

By Richard J. Myers, MD

In 1982, Daniel K. Lowe, MD, and his colleagues conducted a non-autopsy, retrospective analysis of 762 severely injured patients admitted to 23 hospitals in a six-county area, including Portland and the surrounding rural areas. The patients had been transported from the injury scene to the nearest hospital without regard to the hospital's special capabilities. At that time, hospitals had not been designated or categorized as trauma centers. Outcomes for 16 percent of all injured patients, including 25 percent of the fatalities, were considered "inappropriate" for the severity of injury that had been incurred by the patient. Furthermore, the study demonstrated that the average time required for a surgeon to respond and attend to an injured patient was greater than one hour.¹

In 1983, Senate Joint Resolution 23 was introduced by Senator Starkovich and then-Senator John Kitzhaber to authorize the Department of Human Services to develop a plan for a statewide trauma system.

In 1984, the Oregon Trauma Plan, which included preset standards for prehospital trauma care, trauma center triage criteria, trauma center designation, system-wide quality assurance, research and injury prevention, was completed.

The Oregon Legislature passed Senate Bill 147 in 1985, authorizing the creation of a statewide trauma system. In September of 1985, Governor Victor Atiyeh signed this bill, making Oregon one of the few states in the nation to approach trauma care in a systematic manner. The original legislation has been amended over the years and is presently codified as Oregon Revised Statutes (ORS) 431.607 et seq. The administrative rules that implement the legislation, first promulgated by the Department of Human Services on September 20, 1985, are set forth as Oregon Administrative Rules (OAR) Chapter 333, Division 200.

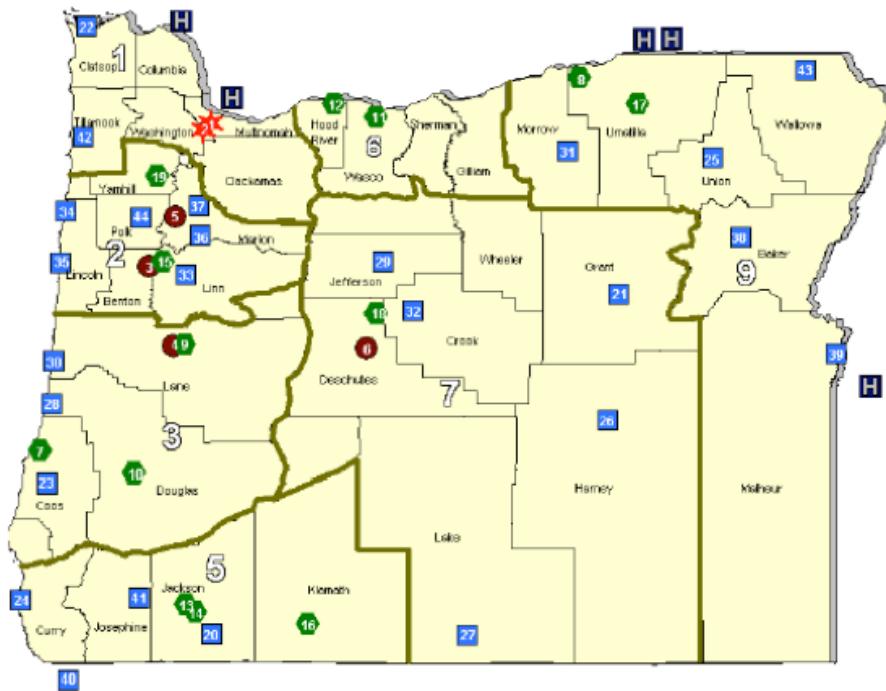
In summary, the statutes and rules:

- create the Oregon Trauma System (OTS) and the Oregon Trauma Registry (OTR);
- provide for a State Trauma Advisory Board (STAB) and seven Area Trauma Advisory Boards (ATABs) to advise the Department of Human Services with respect to the Oregon Trauma System and the Oregon Trauma Registry;
- require the development of a state trauma plan and area trauma plans; provide authority for the designation² of trauma centers in ATAB 1 (the Portland metropolitan area) and for the categorization³ of trauma facilities in all other areas;
- provide for the Division to collect and analyze data regarding all aspects of trauma care;
- require a performance monitoring process and provide for the confidentiality of all information involved in this process;
- require periodic reports to the Legislature; and
- provide financing for the Oregon Trauma System Program.

The Department of Human Services' EMS & Trauma Systems Section, STAB, and seven ATABs collaborate to fulfill the mandates of the trauma system legislation.

Today, Oregon is recognized throughout the nation as a leader in trauma systems development. It was the first state to develop a system that included small rural hospitals as well as large urban facilities and that was voluntarily entered into by the hospitals. The Oregon Trauma System also includes a volunteer Area Trauma Advisory Board in seven regions that plan, implement and monitor system activities.

Oregon Trauma System Hospitals



Revised: February 1, 2012

Oregon Trauma System At-A-Glance

- 44 hospitals throughout Oregon participate in the trauma system.
- The Oregon Trauma System includes six hospitals outside of Oregon – four in Washington, one in Idaho and one in California.
- Trauma patients are transported by 121 EMS agencies within the trauma system as of 2011.
- When the Oregon Trauma System began in 1989, approximately 3,900 patients were treated that year. By 2011, the number of patients treated in the Oregon Trauma Registry was 9,040.
- In 1991, approximately 300 patients were transferred in the Oregon Trauma System. By 2011, the number of patients transferred in the Oregon Trauma Registry was 2,448.
- The TOTAL number of patient records in Oregon Trauma Registry from 2011 is 11,488!

- Level I**
1. Legacy Emanuel Hospital & Health Center, Portland
 2. Oregon Health & Science University, Portland

- Level II**
3. Good Samaritan Regional Medical Ctr., Corvallis
 4. Sacred Heart Medical Center, Eugene
 5. Salem Hospital, Salem
 6. St. Charles Medical Center, Bend

- Level III**
7. Bay Area Hospital, Coos Bay
 8. Good Shepherd Medical Center, Hermiston
 9. McKenzie-Willamette Hospital, Springfield
 10. Mercy Medical Center, Roseburg
 11. Mid-Columbia Medical Center, The Dalles
 12. Providence Hood River Hospital, Hood River
 13. Providence Medford Medical Center, Medford
 14. Rogue Valley Medical Center, Medford
 15. Samaritan Albany General Hospital, Albany
 16. Siletz Lakes Medical Center, Klamath Falls
 17. St. Anthony Hospital, Pendleton
 18. St. Charles Medical Center, Redmond
 19. Willamette Valley Medical Center, McMinnville

- Level IV**
20. Ashland Community Hospital, Ashland
 21. Blue Mountain Hospital, John Day
 22. Columbia Memorial Hospital, Astoria
 23. Coquille Valley Hospital, Coquille
 24. Curry General Hospital, Gold Beach
 25. Grande Ronde Hospital, La Grande
 26. Haney District Hospital, Burns
 27. Lake District Hospital, Lakeview
 28. Lower Umpqua Hospital, Reedsport
 29. Mountain View Hospital, Madras
 30. Peace Harbor Hospital, Florence
 31. Pioneer Memorial Hospital, Heppner
 32. Pioneer Memorial Hospital, Prineville
 33. Samaritan Lebanon Community Hospital, Lebanon
 34. Samaritan North Lincoln Hospital, Lincoln City
 35. Samaritan Pacific Communities Hospital, Newport
 36. Samaritan Memorial Hospital, Stayton
 37. Silverton Hospital, Silverton
 38. St. Alphonsus Medical Center, Baker City
 39. St. Alphonsus Medical Center, Ontario
 40. Sutter Coast Hospital, Crescent City, CA
 41. Three Rivers Community Hospital, Grants Pass
 42. Tillamook County General Hospital, Tillamook
 43. Walla Walla Memorial Hospital, Enterprise
 44. West Valley Hospital, Dallas



SW Washington Medical Center, Vancouver, WA – Level 2
St. John Medical Center, Longview, WA – Level 3
St. Mary Medical Center, Walla Walla, WA – Level 3
Walla Walla General Hospital, Walla Walla, WA – Level 3
St. Alphonsus Regional Medical Center, Boise, ID – Level 2

For more information, please contact the Oregon Emergency Medical Services and Trauma System Program: 800 NW Oregon Street, Suite 465, Portland, OR 97232, email: ems.trauma@state.or.us, phone: (971) 673-0520, fax : 971-673-0555

**Adapted from materials provided by the Oregon Emergency Medical Services and Trauma Systems, of the Oregon Office of the State Public Health Director.

1. Lowe DK, Gately HL, Goss JR, Frey CL, Peterson CG. Patterns of death, complication, and error in the management of motor vehicle accident victims: implications for a regional system of trauma care. *e. J Trauma*. 1983;23:503-9..
2. Designation means a competitive process for identifying the level of hospitals' trauma care capability and commitment. This process selects a limited number of hospitals which meet criteria to receive trauma system patients.
3. Categorization means a process for determining the level of hospitals' trauma care capability and commitment. Any hospital that meets criteria to receive trauma system patients may be categorized.

Bone & Soft Tissue Tumors

By James Hayden, MD

The orthopaedic oncology team consists of Yee Doung, MD, James Hayden, MD, and Kayleen Welbourn, PA. We work in tandem with Chris Ryan, MD, in medical oncology, Suman Malempati, MD, in pediatric oncology, Arthur Hung, MD, in radiation oncology, Don Sauser, MD, in musculoskeletal radiology and Atiya Mansoor, MD, in pathology. This represents the only exclusively sarcoma focused treatment team in Oregon. In addition to the core sarcoma group, in the last year we have partnered with microvascular surgery, spine surgery, general surgical oncology, urologic oncology and gynecologic oncology to provide surgical care for complex sarcoma patients.

The sarcoma team has an institution-specific protocol for soft tissue sarcoma treatment involving adjuvant chemotherapy, dose intense radiation therapy and surgical resection. We are currently enrolling patients on an OHSU-specific imaging protocol to monitor the effects of chemotherapy. In addition to our own studies, we are actively participating in several multicenter trials for both adult and pediatric sarcomas. For soft tissue sarcomas, our program has one of the highest enrollment rates.

Over the last five years, we have averaged 165 sarcoma cases per year. Approximately one-third of these patients require an oncologic prosthesis as part of the reconstruction. This type of prosthesis has a published infection rate of 10 to 20 percent. Our infection rate over the last several years is consistently below 10 percent. Aseptic loosening is the second most common reason for an oncologic prosthesis to fail. We have been using a prosthesis with osteogenic integration through a compression system for fixation. This device allows fixation in a very short segment of bone and seems to be working very well. Our aseptic loosening rates are well below the expected rates in the literature.

Bone and Soft Tissue Tumors Highlights

- Sarcoma team
- Weekly sarcoma specific tumor board
- Combined cases with general surgery, microvascular, gynecologic oncology, urologic oncology, spine surgical teams
- Enrollment in multicenter trials
- OHSU trials protocol
- 165 sarcoma cases average
- Over 50 oncologic prostheses per year
- Infection rate below average for oncologic surgery

Sports Medicine

By Dennis Crawford, MD, PhD

The clinical practice of Sports Medicine at OHSU currently encompasses a multi-disciplinary approach that brings operative and non-operative care together for all elements of musculoskeletal injury in athletes, recreationalists, laborers and patients of all ages. Since establishing a partnership between orthopedic surgeon Dennis Crawford MD, PhD (director), and family practice medicine provider Jim Chesnutt, MD (medical director), in 2006, growth of Sports Medicine-related services at OHSU has reached a level unequalled in the Pacific Northwest. Currently, the umbrella of OHSU Sports Medicine includes eight physicians and surgeons with clinical practices dedicated to sports medicine. Each are sub-specialty fellowship-trained in Sports Medicine and include orthopedic surgeons, family practitioners, emergency physicians and internal medicine specialties. As well, clinical and research support is provided by our dedicated physicians assistants specializing in orthopedic sports medicine and a staff of 15 physical therapists, athletic trainers and research assistants. Our team philosophy and infrastructure bring cooperation between nationally and internationally recognized experts in a variety of areas, including women's health and sports medicine, side-line and slope-side injury management, ACL injury prevention, concussion evaluation and treatment, minimally invasive hip surgery, arthroscopic shoulder and knee surgery and cutting-edge cartilage repair, regeneration and transplant.

As a result of our unique academic partnership within the Department of Orthopaedics & Rehabilitation, subspecialty care in every orthopaedic discipline (fracture care, hand, elbow, physical medicine, rehabilitation, oncology, foot and ankle, arthroplasty, pediatrics and spine) is always immediately available from our additional 15

orthopedic surgical partners. Similarly, working side-by-side with our peri-operative medicine team brings unequaled access to same day (or outpatient) surgical procedures in cooperation with sub-specialty regional anesthesiologists. This pioneering program has allowed our surgeons to both routinely extend postoperative pain relief (up to 72 hours) after commonly performed procedures (e.g.- arthroscopic rotator cuff repair, ACL reconstruction, fracture repair) and broaden the spectrum of outpatient care to more advanced procedures (knee cartilage transplant, multi-ligament knee dislocation, joint arthroplasty, hip arthroscopy).

The breadth and depth of our faculty are exemplified by Dr. Chesnutt's background, interests and experience. Since graduating from Stanford, he has dedicated his medical career to Oregonians from his time as a medical student and resident at OHSU with a brief hiatus to train and serve in the military. Since returning to the faculty 18 years ago, his work at OHSU exemplifies the cooperation between medical practitioners and surgeons, working day to day in both the Orthopedic and Sports Medicine clinics. Outside the clinic, he sets the standard for community service and teaching. He has won multiple awards for his mentorship to medical students and residents, served as team physician for local schools and athletic organizations including the Portland Timbers, Oregon Ballet Theater and his alma mater Wilson High School. His expertise on concussion evaluation and treatment sets a national standard and includes recognition of his work drafting and helping pass Max's Law in Oregon, which created the first legislation in the United States directing concussion management in high schools.

Andrea Herzka, MD, joined our department in 2006 following her medical training at University

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of California, San Francisco, Johns Hopkins and the internationally renowned sports medicine fellowship at the University of Pittsburgh. Her experience with hip arthroscopy is unparalleled in Oregon and her dedication to her patients and young athletes is exemplified by years of acting as the team physician at Saint Mary's Academy and Beaverton High School. Andrea's clinical interest includes knee ligament injury, shoulder instability in the throwing athletes and soft tissue injury about the hip.

Dr. Crawford, recently appointed Director of Sports Medicine, arrived at OHSU in 2001 following an orthopedic fellowship in shoulder and knee surgery at University of California, San Francisco. Prior, his training included an orthopedic trauma fellowship at Brown University, where he also trained as an orthopedic resident after completing his MD, PhD education at Boston University School of Medicine. Now, Dr. Crawford focuses his clinical expertise on routine and complex shoulder and knee soft tissue injury, with a particular interest on cartilage injury and arthritis prevention. These efforts have led to lectureships around the globe and recent publications in *The American Journal of Sports Medicine*, *The Journal of Bone and Joint Surgery*, *The Knee and Cartilage*. Currently, he is the lead principal investigator of multiple national and international clinical trials focused on new approaches and biologic solutions to the burgeoning fields of cartilage repair surgery, osteoarthritis risks and early treatments for prevention of disease progression. Physician assistant Samantha Quilici, also an OHSU graduate, divides her time between peri-operative and non-surgical clinical care of patients with sports injury and clinical research. Acting as a sub-specialty care provider, student and resident educator, patient advocate and clinical trial enrollment expert, Sam truly embodies the academic clinician physician assistant.

Kerry Kuehl, MD, directs the Human Performance Lab in the Division of Health Promotion and Sports Medicine in the Department of Internal Medicine.

Here, a world-renowned team of clinical researchers continues to provide primary and sports medicine care to patients, including our Portland firefighters and police. Dr. Kuehl's efforts, in both the PHLAME and SHEILD studies, similar to the ATHENA and ATLAS steroid prevention and health promotion studies of his colleagues Linn Goldberg, MD, and Diane Elliott, MD, are considered the standard in sports medicine for healthy work activity.

Our colleagues in Sports Medicine family practice are led by Associate Professor Charles Webb, DO. Dr. Webb's clinical interests include musculoskeletal injury in all anatomic areas, women's health and primary care. He dedicates his community service time to acting as the lead team physician for Portland State University, Lewis & Clark College and Southridge High School. Academically, he is nationally recognized for his role as the OHSU Sports Medicine fellowship director, having established this program in 2010.

Ryan Petering, MD, the program's first graduate, has subsequently joined our faculty and added expertise in ultrasound-guided diagnosis/therapeutics and endurance athlete medicine. He has also established, in cooperation with the Department of Orthopedics & Rehabilitation, a "Runner's Clinic" and leads the medical team for the Rock and Roll Marathon as well as the Rose City Rollers.

Our most recent faculty colleague additions include Melissa Novak, DO, and Rachel Bengtzen, MD. Dr. Novak's clinical interests include primary care and female and adolescent sports medicine. Her recent involvement as team doctor at Lincoln High School has included extending our ACL injury prevention program in collaboration with parents, coaches and athletes.

Dr. Bengtzen's training and expertise include both sports medicine and emergency medicine. Her unique background allows her to focus clinically on non-urgent and urgent sports medicine injuries. Academically, this is exemplified by her study of treatment for "side-line" cardiac events in an effort to develop algorithm training analogous to ATLS and ACLS protocols.

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This depth and diversity of our OHSU Sports Medicine team is unified within the Department of Orthopedics & Rehabilitation through our mutual interest and philosophy of improving patients' lives by restoring their lifestyle and livelihood after injury. The breadth and extent of our OHSU Sports Medicine programs provides all levels of care, from urgent same-day appointments, to referral-based tertiary care and second opinion for all elements of sports medicine, orthopedic and musculoskeletal sub-specialties. By applying innovative approaches combined with high quality, patient-centered care and clinically oriented research, our team has become distinguished regionally and nationally as leaders in sports medicine patient care, clinical outcomes and scholarship.

Research – Published Articles

NeoCart, an autologous cartilage tissue implant, compared with microfracture for treatment of distal femoral cartilage lesions: an FDA phase-II prospective, randomized clinical trial after two years. Crawford DC; DeBerardino TM; Williams RJ 3rd. *J Bone Joint Surg Am.* 2012;94:979-89.

BACKGROUND

Despite introduction of autologous chondrocyte therapy for repair of hyaline articular cartilage injury in 1994, microfracture remains a primary standard of care. NeoCart, an autologous cartilage tissue implant, was compared with microfracture in a multisite prospective, randomized trial of a tissue-engineered bioimplant for treating articular cartilage injuries in the knee.

METHODS

Thirty patients were randomized at a ratio of two to one (two were treated with an autologous cartilage tissue implant [NeoCart] for each patient treated with microfracture) at the time of arthroscopic confirmation of an International Cartilage Repair Society (ICRS) grade-III lesion(s). Microfracture or cartilage biopsy was performed. NeoCart, produced by seeding a type-I collagen matrix scaffold with autogenous chondrocytes and bioreactor treatment, was implanted six weeks following arthroscopic cartilage biopsy. Standard evaluations were performed with validated clinical outcomes measures.

RESULTS

Three, six, twelve, and twenty-four-month data are reported. The mean duration of follow-up (and standard deviation) was 26 ± 2 months. There were twenty-one patients in the NeoCart group and nine in the microfracture group. The mean age (40 ± 9 years), body mass index (BMI) (28 ± 4 kg/m²), duration between the first symptoms and treatment (3 ± 5 years), and lesion size (287 ± 138 mm² in the NeoCart group and 252 ± 135 mm² in the microfracture group) were similar between the groups. Adverse event rates per procedure did not differ between the treatment arms. The scores on the

Short Form-36 (SF-36), Knee Injury and Osteoarthritis Outcome Score (KOOS) activities of daily living (ADL) scale, and International Knee Documentation Committee (IKDC) form improved from baseline ($p < 0.05$) to two years postoperatively in both treatment groups. In the NeoCart group, improvement, compared with baseline, was significant ($p < 0.05$) for all measures at six, twelve, and twenty-four months. Improvement in the NeoCart group was significantly greater ($p < 0.05$) than that in the microfracture group for the KOOS pain score at six, twelve, and twenty-four months; the KOOS symptom score at six months; the IKDC, KOOS sports, and visual analog scale (VAS) pain scores at twelve and twenty-four months; and the KOOS quality of life (QOL) score at twenty-four months. Analysis of covariance (ANCOVA) at one year indicated that the change in the KOOS pain ($p = 0.016$) and IKDC ($p = 0.028$) scores from pretreatment levels favored the NeoCart group. Significantly more NeoCart-treated patients ($p = 0.0125$) had responded to therapy (were therapeutic responders) at six months (43% versus 25% in the microfracture group) and twelve months (76% versus 22% in the microfracture group). This trend continued, as the proportion of NeoCart-treated patients (fifteen of nineteen) who were therapeutic responders at twenty-four months was greater than the proportion of microfracture-treated participants (four of nine) who were therapeutic responders at that time.

CONCLUSIONS

This randomized study suggests that the safety of autologous cartilage tissue implantation, with use of the NeoCart technique, is similar to that of microfracture surgery and is associated with greater clinical efficacy at two years after treatment.

Research – Published Articles

The biomechanical relevance of rotator cable tears in a cadaveric shoulder model. Mesiha MM; Derwin KA; Sibole SC; Erdemir A; McCarron JA. *J Bone Joint Surg Am.* 2013: in press.

BACKGROUND

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

METHODS

Twelve human cadaveric shoulders were randomized to undergo simulation of equivalent sized supraspinatus tears of either the anterior rotator cable ($n=6$) or the adjacent rotator 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 computed.

RESULTS

Our results demonstrated that A) tear gap distance was significantly greater for large cable tears (median 5.2 mm) than large crescent tears (median 1.3 mm) ($p=0.002$); B) decrease in supraspinatus tendon stiffness was significantly greater in small ($p=0.002$) and large ($p=0.002$) cable tears when compared to equivalent-sized crescent tears; and C) regional strains across the supraspinatus were significantly increased in magnitude and altered in distribution by tears involving the anterior insertion of the rotator cable.

CONCLUSIONS

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

CLINICAL RELEVANCE

While further studies are needed, clinicians should consider early repair of rotator cable tears, which may need surgical intervention to address their biomechanical pathology. In contrast, surgical treatment may be more safely delayed in pursuit of conservative measures to manage rotator crescent tears.

(continued)

Tear Condition	Outcome Measure	Crescent Group (n=6)	Cable Group (n=6)	p-value
Pre-tear	Stiffness (N/mm)	157 (125-291)	171 (103 to 267)	0.937
Small Tear	Tear Gap (mm)	0.4 (-0.3 to 1.0)	1.0 (-0.6 to 1.9)	0.132
	Stiffness (N/mm)	158 (100 to 277)	85 (71 to 145)	0.024
	Stiffness Decrease from Pre-tear	-5% (15% to -20%)	-44% (-31% to -52%)	0.002
Large Tear	Tear Gap (mm)	1.3 (-0.2 to 1.5)	5.2 (2.8 to 9)	0.002
	Stiffness (N/mm)	125 (81 to 213)	61 (39 to 88)	0.004
	Stiffness Decrease from Pre-tear	-24% (-13% to -36%)	-63% (-52% to -76%)	0.002

Table 2. Tear gap distance and pre- and post-tear tendon stiffness. Medians (ranges) are reported for all outcomes, and p-values are reported for comparisons between crescent and cable groups.

Research – Published Articles

"Failure with continuity"—A common mechanism of rotator cuff repair "healing."

McCarron JA; Derwin KA; Bey MJ; Polster JM; Schills JP; Ricchetti ET; Iannotti JP. *Am J Sports Med.* 2013; in press.

BACKGROUND

Ten to seventy percent of rotator cuff repairs form a recurrent defect after surgery. The relationship between retraction of the repaired tendon and formation of a recurrent defect is not well defined.

PURPOSE

Measure the prevalence, timing and magnitude of tendon retraction following rotator cuff repair and correlate these outcomes with formation of a full-thickness recurrent tendon defect on MR imaging, as well as clinical outcomes. We hypothesized that: (i) tendon retraction is a common phenomenon, though not always associated with a recurrent defect, (ii) formation of a recurrent tendon defect correlates with the timing of tendon retraction, and (iii) clinical outcome correlates with the magnitude of tendon retraction at 52 weeks and the formation of a recurrent tendon defect.

STUDY DESIGN

Prospective Case Series

METHODS

Fourteen patients underwent arthroscopic rotator cuff repair. Tantalum markers placed within the repaired tendons were used to assess tendon retraction by CT scan at 6, 12, 26 and 52 weeks post-operation. MRI was performed to assess for recurrent tendon defects. Shoulder function was evaluated using the PENN score, VAS score, and isometric scapular-plane abduction strength.

RESULTS All rotator cuff repairs retracted away from their position of initial fixation during the first year after surgery (range 5.7-23.2mm, mean $16.1 \pm 5.3\text{mm}$), yet only 30% of patients formed a recurrent defect. Patients who formed a recurrent defect tended to have more tendon retraction during the first 6 weeks after surgery (9.7 ± 6.0

mm) than those who did not form a defect ($4.1 \pm 2.2\text{mm}$) ($p=0.08$), but the total magnitude of tendon retraction was not significantly different between patient groups at 52 weeks. There was no significant correlation between the magnitude of tendon retraction and the PENN score ($r=0.01$, $p=0.97$) or normalized scapular abduction strength ($r=-0.21$, $p=0.58$). However, patients who formed a recurrent defect tended to have lower PENN scores at 52 weeks ($p=0.1$).

CONCLUSIONS

Early tendon retraction, but not the total magnitude, correlates with formation of a recurrent tendon defect and worse clinical outcomes. "Failure with continuity" (tendon retraction without a recurrent defect) appears to be a common phenomenon following rotator cuff repair.

CLINICAL RELEVANCE

Our results corroborate the findings of others that about 80% of the tendon retraction occurs in the first 12 weeks after surgery. These data suggest that repairs should be protected in early post-operative period and repair strategies should endeavor to mechanically and biologically augment the repair during this critical early period.

(continued)

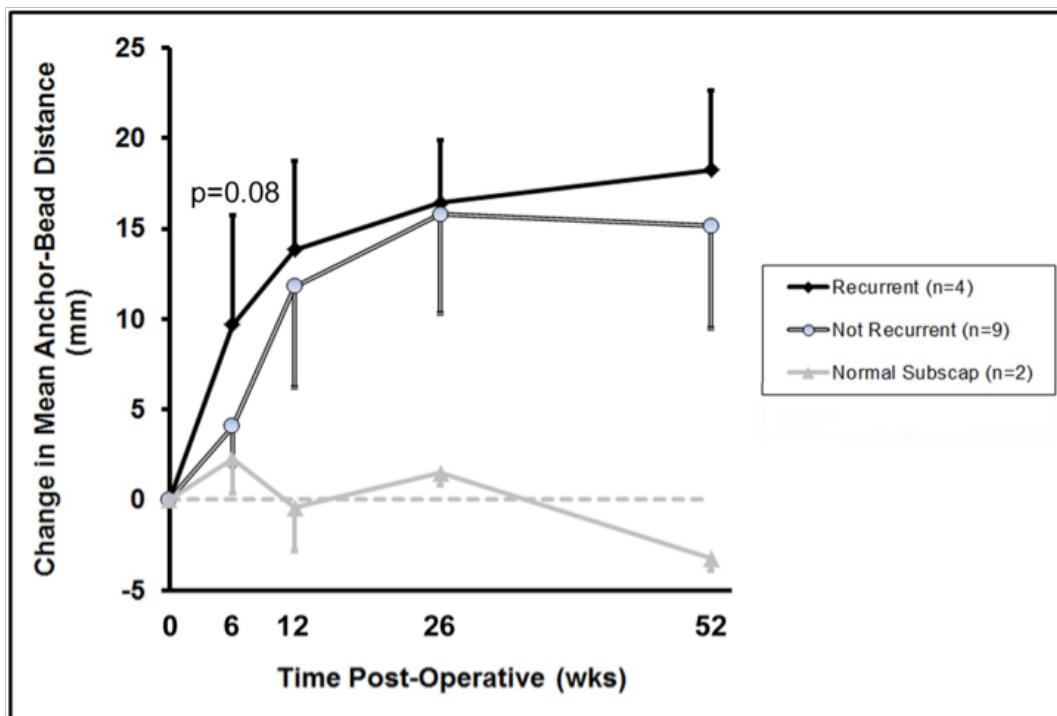


Figure 3. Change in distance between anchors at the repair site and tendon markers within the repaired tendon (relative to the day of surgery). When evaluated over the entire 52-week study period, there was no overall difference in the change of anchor-bead distance between patients that did and those that did not form a recurrent defect (i.e., no overall group effect, $p=0.12$). However, between the day of surgery and six weeks post-operation, anchor-bead distance tended to increase significantly more in patients that formed a recurrent defect than in patients that did not ($p=0.08$). Anchor-bead distances in the intact subscapularis tendons are also shown.

Research – Published Articles

Early prevalence of post-traumatic stress disorder in spinal trauma patients. Ching AC; Marshall LM; Hart RA; Zusman NL; Darnall BD; Ragel BT; Nemecek AN; Lanning K; Watson KM; Yoo JU. *Spine J.* 2012;12(9S):S15.

BACKGROUND/CONTEXT

Post-traumatic stress disorder (PTSD) is a serious condition that adversely affects mental and physical functioning. Studies have demonstrated that patients with PTSD admitted for non-specific traumatic injury have worse functional outcomes. To our knowledge, the prevalence of PTSD and its effect on global health has not been documented among spine trauma patients.

PURPOSE

To estimate the prevalence of PTSD symptoms among spinal trauma patients and determine the relation between PTSD symptoms and global health-related quality of life scores.

STUDY DESIGN/SETTING

Prospective cohort study at a Level 1 Trauma Center.

PATIENT SAMPLE

Adult spine trauma patients admitted between October 2009 and December 2011.

Outcome Measures: PTSD associated symptoms were measured made using the PTSD Check List – Civilian (PCL-C) and the Impact of Events Scale-Revised (IES). Both scales are validated to assess for PTSD and PTSD symptoms. We used the Short Form 12 (SF-12) survey to measure global health. The SF-12 yields a Mental Composite Score (MCS) and a Physical Composite Score (PCS) as measures of functioning in each domain.

METHODS

Patients' responses were collected via interview or mail at five time points: hospital admission, 6 weeks, 3 months, 6 months and 12 months. Scores of 35 and higher on the PCL-C or 27 and higher on the IES were defined as positive for PTSD associated

symptoms. We evaluated the relation of SF-12 MCS and PCS and to PTSD symptoms using correlation coefficients and p-values. We analyzed various demographic risk factors, such as depression at entry (defined as MCS ≤45), sex, age, educational status, in relation to PTSD symptoms using Chi-Square and Fisher Exact Tests.

RESULTS

One hundred and twenty patients were enrolled in this study, with an average follow up of 6.5 months. At any time point during the study, the prevalence of PTSD symptoms was 58% (70/120). The prevalence of PTSD symptoms remained stable during the study period: 39%, 38%, 32%, 42%, and 40% at initial intake, 6 weeks, 3 months, 6 months and 12 months, respectively. At 3 months, patients' SF-12 MCS scores were highly correlated with their PCL-C scores ($r=0.77$, $p<0.01$); however, there was a weak correlation between patients' SF-12 PCS and PCL-C scores ($r=0.27$). Depressed patients at entry were approximately 2 to 2.5 times more likely to develop PTSD symptoms than not depressed patients (50% versus 26% at 3 months, $p=0.10$, 79% versus 32% at 6 months, $p<0.01$, and 63% versus 25% at 12 months, $p=0.03$). Female sex was the only demographic risk factor which demonstrated a significant difference in prevalence (71% versus 51%, $p=0.05$).

CONCLUSION

Surgeons treating spinal trauma should be aware that the prevalence of PTSD associated symptoms is very high among patients who have sustained a traumatic spine injury and is strongly correlated with worse mental, but not physical, scores on a global health survey. The important factors that predict the presence of PTSD symptoms in these patients appear to be depression at entry and female sex.

Research – Published Articles

The relationship between the number of levels fused and perioperative complications in elective thoracolumbar fusions. Munch JL; Zusman NL; Bell CD; Lieberman EG; Smith S; Ching AC; Hart RA; Yoo JU. *Spine J.* 2012;12(9S):93-4S.

BACKGROUND/CONTEXT

It is generally accepted that the rate of complications from spine surgery is directly related to the number of segments fused. Although multiple segment fusions have been linked to peri-operative morbidity and mortality, there is no consensus regarding the definition of "multiple levels."

PURPOSE

To determine the risk of developing major medical and surgical complications and their relationship to the number of segments fused in elective thoracic/lumbar arthrodesis.

STUDY DESIGN/SETTING

Retrospective cohort study at one institution.

PATIENT SAMPLE

Seven hundred and nine patients undergoing elective thoracic/lumbar fusion between 2007 and 2011.

OUTCOME MEASURES

Presence of major medical and surgical complications occurring within the 30-day post-operative period.

METHODS

The cohort was divided by the number of segments fused: 1, 2-3, 4-8, 9-22 segments; the means of each group followed an exponential progression (n^2). The surgical and medical complication rates were analyzed. The rate of medical complications was further analyzed with respect to pre-surgical American Society of Anesthesiologists (ASA) score by subdividing the patients into ASA 1-2 and ASA 3-4 groups. We determined the best fit function as a means of evaluating the mathematical relationship between the number of fusion segments and the complication rate. The correlation coefficients and p-values for the rates and segments were determined for each comparison.

RESULTS

There was a different mathematical relationship between the number of fusion segments as compared to medical or surgical complication rates. The surgical complication rates were 3.9, 2.1, 7.0 and 16.3% for the four sequential groups, which was approximately a linear relationship ($y = 0.95x$, $r=0.96$, $p<0.001$). The medical complication rates for the four groups were 5.2, 14.8, 16.1, and 20.7 %. This relationship was not linear. The rate sharply increased from the 1 segment group to the 2-3 segments group (increase of 7.3% per segment). In comparison, this increase was only 0.5% per segment between the 2-3 and the 9-22 fused segments groups. This relationship is logarithmic ($y=5.5\ln(x)$, $r=0.95$, $p<0.001$).

The rate of major medical complications behaved differently for patients with ASA 1-2 and ASA 3-4. For patients with ASA scores of 3-4, the complication rates were 5.8, 23.4, 21.5, and 29.4% as compared with 5.2, 7.8, 9.5, 7.7% for the ASA 1-2 group. This demonstrates that the rapid increase in the overall medical complication rates between the 1 segment group and the 2-3 segment group is due to the ASA-3-4 patients.

CONCLUSION

As expected, the surgical complication rate increased linearly with the number of segments fused. However, this expectation did not hold true for the medical complications. The medical complication rate for the ASA 1-2 group remained relatively stable with increasing fusion segments; however, the inflection point for increased risk of medical complications for the ASA 3-4 group occurred after a single fused segment. Our data suggest that when stratified for risk of medical complications, the concept of "multi-level fusion" may apply to any patient with ASA 3 or higher undergoing greater than a single segment fusion.

Research – Published Articles

Complication rates for spinal fusion are associated with a number of perioperative factors, but their influences are dependent on ASA classification. Munch JL; Zusman NL; Philipp TC; Stucke RS; Ching AC; Yoo JU. *Spine J.* 2012;12(9S):136S.

INTRODUCTION

Major medical complications are frequent occurrences in spinal arthrodesis and often lead to poor results. We have systematically examined our patients undergoing an elective thoracic/lumbar fusion to establish the prevalence of medical complications and associated risk factors.

METHODS

Our retrospective study reviewed the clinical course of 709 patients undergoing spine fusion surgeries between 2007 and 2011. We evaluated the rate of major medical complications within the 30-day postoperative period with respect to American Society of Anesthesiologists (ASA) score, age, sex, operative time, number of levels, EBL, fluids, and intra-operative vital signs (temperature, mean arterial pressure, heart rate).

RESULTS

The major determining factor was ASA classification. The overall rate was 20% for ASA 3-4 and 7% for ASA 1-2. The factors such as operative time, total levels, EBL and fluids were only important for ASA 3-4 patients. They did not influence the rates for ASA 1-2 patients. For example, the rate in the ASA 1-2 group rose from 5.2% for 1 level fusion to 7.7% for 9-22 levels, while the ASA 3-4 group rose from 5.8% to 29.4%. Similarly, the rate for the operative time of 1-3 hours was low for both groups (7% and 13% for ASA 1-2 and ASA 3-4), but when the operative time was >6 hours, the rate for the ASA 1-2 group remained low (10%), while the ASA 3-4 group markedly increased (30%).

There was no statistically significant difference in the rates for sex, mean arterial pressure or heart rate. However, lower intra-operative body temperature was associated with a lower rate for ASA 3-4 patients.

DISCUSSION AND CONCLUSION

This study demonstrates that the ASA score is a strong predictor of risk following elective thoracic/lumbar arthrodesis, and all other factors must be evaluated not as independent factors, but dependent factors to ASA score.

Research – Published Articles

Traditional threshold for retropharyngeal soft-tissue swelling is poorly sensitive for the detection of cervical spine injury on computed tomography in adult trauma patients.

Hiratzka JR; Yoo JU; Ko JW; Zusman NL; Anderson JC; Hiratzka SL; Ching AC. *Spine (Phila Pa 1976)*. 2013;38:E211-6. [Epub ahead of print].

STUDY DESIGN

Retrospective cohort study

OBJECTIVE

To examine the diagnostic value of prevertebral soft tissue swelling in the setting of cervical spine trauma.

SUMMARY OF BACKGROUND DATA

In adult trauma patients, an increase in the thickness of the retropharyngeal soft tissues is commonly used as a potential indicator of occult injury, but no studies have examined this parameter using CT as a screening modality.

METHODS

541 trauma patients with injuries at any level of the spine were examined with CT. Patients with cervical injury were divided into those requiring noninvasive (observation or c-collar, n=142) management, and those requiring invasive (surgery or halo, n=61) treatment. A control group of patients with isolated thoracic or lumbar injuries was used for comparison (n=542). Retropharyngeal soft tissues were measured at the cranial and caudal endplates of all cervical levels on sagittal and axial CT. Sensitivity and specificity were calculated for +1, +2 and +3 standard deviations from mean values.

RESULTS

Sensitivity for detection of injury was found to be universally poor for all measurement groups. This ranged from 14.4% to 21.2% at +1 SD to 5.3-8.7% at +2 SD. Positive and negative predictive values for injury were also universally poor, ranging from 38% to 75%.

DISCUSSION

Soft tissue swelling as a sentinel sign of cervical

spine injury demonstrates consistently high specificity and low sensitivity, precisely the opposite of what would be desired in a screening test. This study shows at best a sensitivity of 21.6% when using this parameter for the detection of these injuries in adult trauma patients.

CONCLUSIONS

Based on the results of this study, we recommend against the routine use of measurement of the prevertebral soft tissues on CT as a screening tool for cervical spine injury in adult trauma patients.

Research – Published Articles

Postoperative prevertebral soft tissue swelling does not affect the development of chronic dysphagia following anterior cervical spine surgery. Khaki F; Zusman NL; Nemecek AN; Ching AC; Hart RA; Yoo JU. *Spine (Phila Pa 1976)*. 2013; [Epub ahead of print].

STUDY DESIGN

Prospective cohort study

OBJECTIVE

To characterize the relation between postoperative soft tissue swelling and the development of chronic dysphagia after anterior cervical spine surgery. Chronic dysphagia was defined as dysphagia that persists greater than one year.

SUMMARY OF BACKGROUND DATA

Dysphagia is commonly reported in the early postoperative period following anterior cervical spine surgery. Although prevertebral soft tissue swelling (STS) has been hypothesized as a potential risk factor for development dysphagia, no studies have assessed STS' relation to dysphagia that persists greater than one year.

METHODS

Sixty-seven patients who underwent elective anterior cervical spine surgery from 2008-2011 and completed a dysphagia questionnaire were included in the study. Prevertebral soft tissue swelling was measured at the caudal endplates of C2 and C6 on plain lateral cervical radiographs preoperatively, immediate, six and 12 weeks postoperatively. The presence and severity of chronic dysphagia was assessed using the Bazaz-Yoo Dysphagia Score. The prevalence of dysphagia in relation to soft tissue swelling was evaluated using the Wilcoxon Rank-Sum Test.

RESULTS By six weeks after surgery, 89% of STS at C2 and 97% of STS at C6 had resolved, as compared to preoperative values. The overall dysphagia prevalence in our cohort was 73%, with 48% reporting no or mild symptoms. Moderate symptoms were present in 39% and severe symptoms were present in 13% of the patients.

There was no relation between STS measured at all time points compared to the development of chronic dysphagia. Dysphagia did trend towards significance with higher cervical fusions (C4 and above) and as the number of levels fused increased, but STS did not appear to influence this.

CONCLUSIONS

Postoperative soft tissue swelling is a self-limiting process. The magnitude of soft tissue swelling during the postoperative period does not appear to influence the development of chronic dysphagia.

Research – Published Articles

Incidence of second cervical vertebral fractures far surpassed the rate predicted by the changing age distribution and growth among elderly United States' persons (2005-2008).
Zusman NL; Ching AC; Hart RA; Yoo JU. *Spine (Phila Pa 1976)*. 2012. [Epub ahead of print].

STUDY DESIGN

Nationwide Epidemiological Cohort Study

OBJECTIVE

To characterize the incidence of second cervical vertebral (C2) fractures by age and geographic region among the elderly Medicare population and to elucidate if the rate changed in years 2005 to 2008.

SUMMARY OF BACKGROUND DATA

Recent publications hypothesized that the rate of cervical vertebral fractures may be increasing. To date, there are no published nationwide reports describing the incidence and demographics of these injuries in the elderly US population.

METHODS

Incidence of C2 fracture 2005-2008 was determined by querying PearlDiver Technologies, Inc., a commercially available database, using International Classification of Diseases (ICD-9) Code 805.02. Rates were calculated using the person-counts report as the numerator and the Center for Medicare and Medicare Services mid-year population file as the denominator, and reported per ten-thousand person-years (10,000 p-y). The age and geographic distributions of fractures were examined. Variability in rates were analyzed using the mean, standard deviation, ninety-five percent confidence intervals (95% CI), chi-square tests and Pearson's correlation coefficients.

RESULTS

While the elderly population increased 6% between 2005-2008, the annual incidence of C2 fracture rose 21%, from 1.58 to 1.91 per 10,000 p-y, trending upward in a straight line function ($r = 0.999$, $p = 0.0006$). The incidence of fracture varied between age groups; however an increase was observed in

all age groups. Persons aged 65-74 years (youngest age group) experienced the lowest incidence (0.63 in 2005 to 0.71 in 2008), and the rate of increase was the smallest among the age groups examined (13%). Persons aged 85 and older demonstrated the highest incidence (4.36 to 5.67) and the greatest increase (30%).

CONCLUSIONS

From 2005-2008, the overall incidence of C2 fracture rose at a rate that was 3.5 times faster than the elderly population growth.

Research – Published Articles

The impact of standing regional cervical sagittal alignment on outcomes in posterior cervical fusion surgery. Tang JA; Scheer JK; Smith JS; Deviren V; Bess S; Hart RA; Lafage V; Shaffrey CI; Schwab F; Ames CP; ISSG. *Neurosurgery*. 2012;71:662-9.

BACKGROUND

Positive spinal regional and global sagittal malalignment has been repeatedly shown to correlate with pain and disability in thoracolumbar fusion.

OBJECTIVE

To evaluate the relationship between regional cervical sagittal alignment and postoperative outcomes for patients receiving multilevel cervical posterior fusion.

METHODS

From 2006 to 2010, 113 patients received multilevel posterior cervical fusion for cervical stenosis, myelopathy, and kyphosis. Radiographic measurements made at intermediate follow-up included the following: (1) C1-C2 lordosis, (2) C2-C7 lordosis, (3) C2-C7 sagittal vertical axis (C2-C7 SVA; distance between C2 plumb line and C7), (4) center of gravity of head SVA (CGH-C7 SVA), and (5) C1-C7 SVA. Health-related quality-of-life measures included neck disability index (NDI), visual analog pain scale, and SF-36 physical component scores. Pearson product-moment correlation coefficients were calculated between pairs of radiographic measures and health-related quality-of-life scores.

RESULTS

Both C2-C7 SVA and CGH-C7 SVA negatively correlated with SF-36 physical component scores ($r = -0.43, P < .001$ and $r = -0.36, P = .005$, respectively). C2-C7 SVA positively correlated with NDI scores ($r = 0.20, P = .036$). C2-C7 SVA positively correlated with C1-C2 lordosis ($r = 0.33, P = .001$). For significant correlations between C2-C7 SVA and NDI scores, regression models predicted a threshold C2-C7 SVA value of approximately 40 mm, beyond which correlations were most significant.

CONCLUSION

Our findings demonstrate that, similar to the thoracolumbar spine, the severity of disability increases with positive sagittal malalignment following surgical reconstruction.

Spontaneous improvement of cervical alignment after correction of global sagittal balance following pedicle subtraction osteotomy. Smith JS; Shaffrey CI; Lafage V; Blondel B; Schwab F; Hostin R; Hart R; O'Shaughnessy B; Bess S; Hu SS; Deviren VI; Ames CP; International Spine Study Group. *J Neurosurg Spine*. 2012;17:300-7.

OBJECTIVE

Sagittal spinopelvic malalignment is a significant cause of pain and disability in patients with adult spinal deformity. Surgical correction of spinopelvic malalignment can result in compensatory changes in spinal alignment outside of the fused spinal segments. These compensatory changes, termed reciprocal changes, have been defined for thoracic and lumbar regions but not for the cervical spine. The object of this study was to evaluate postoperative reciprocal changes within the cervical spine following lumbar pedicle subtraction osteotomy (PSO).

METHODS

This was a multicenter retrospective radiographic analysis of patients from International Spine Study Group centers. Inclusion criteria were as follows: adults (>18 years old) with spinal deformity treated using lumbar PSO, a preoperative C7-S1 plumb line greater than 5 cm, and availability of pre- and postoperative full-length standing radiographs.

RESULTS

Seventy-five patients (60 women, mean age 59 years) were included. The lumbar PSO significantly improved sagittal alignment, including the C7-S1 plumb line, C7-T12 inclination, and pelvic tilt ($p < 0.001$). After lumbar PSO, reciprocal changes were seen to occur in C2-7 cervical lordosis (from 30.8° to 21.6°, $p < 0.001$), C2-7 plumb line (from 27.0 mm to 22.9 mm), and T-1 slope (from -38.9° to -30.4°, $p < 0.001$). Ideal correction of sagittal malalignment (postoperative sagittal vertical alignment < 50 mm) was associated with the greatest relaxation of cervical hyperlordosis (-12.4° vs -5.7°, $p = 0.037$). A change in cervical lordosis correlated with changes in T-1 slope ($r = -0.621$, $p < 0.001$), C7-T12 inclination

($r = 0.418$, $p < 0.001$), T12-S1 angle ($r = -0.339$, $p = 0.005$), and C7-S1 plumb line ($r = 0.289$, $p = 0.018$). Radiographic parameters that correlated with changes in cervical lordosis on multivariate linear regression analysis included change in T-1 slope and change in C2-7 plumb line ($r^2 = 0.53$, $p < 0.001$).

CONCLUSIONS

Adults with positive sagittal spinopelvic malalignment compensate with abnormally increased cervical lordosis in an effort to maintain horizontal gaze. Surgical correction of sagittal malalignment results in improvement of the abnormal cervical hyperlordosis through reciprocal changes.

Research – Published Articles

Preliminary biomechanical proof of concept for a hybrid locking plate/variable pitch screw construct for anterior fixation of type II odontoid fractures. Daniels AH; Magee W; Badra M; Bay B; Hettwer W; Hart RA. *Spine (Phila Pa 1976)*. 2012;37:E1159-64.

STUDY DESIGN

A human cadaveric biomechanical proof-of-concept study.

plate/interfragmentary screw construct may improve clinical outcomes for these fractures.

OBJECTIVE

To test whether adding a locking plate to the anterior surface of C2 attaching directly to the interfragmentary screw may reduce potential for anterior screw cutout and improve construct strength.

SUMMARY OF BACKGROUND DATA

The most common mode of failure for screw fixation of dens fractures is via cutout at the anterior body of C2.

METHODS

A human, cadaveric model of type II dens fractures was created and fixed using either a headless, fully threaded variable pitch screw (FTVPS) or a screw with an attachable locking plate construct (LPC). Following quasistatic loading to failure, stiffness and load to failure were compared using t tests. Mode of failure was determined from radiographical and gross inspection.

RESULTS

Load to failure was greater for the LPC than for the FTVPS alone (498 N vs. 362 N, P = 0.04). The LPC consistently failed via compression of cancellous bone posterior to the lag screw, whereas the FTVPS constructs failed via cutout of the screw from the anterior C2 body.

CONCLUSION

Locking plate supplementation of anterior screw fixation of type II odontoid fractures improves construct strength and changes the failure mechanism from anterior screw cutout to posterior displacement of the screw. An attachable locking

Research – Published Articles

Symptoms of post-traumatic stress following elective lumbar spinal arthrodesis.

Deisseroth K; Hart RA. *Spine (Phila Pa 1976)*. 2012;37:1628-33.

STUDY DESIGN

A prospective cohort study with 100% follow-up.

OBJECTIVE

To assess incidence and risk factors for development of post-traumatic stress disorder (PTSD) symptoms after elective lumbar arthrodesis.

SUMMARY OF BACKGROUND DATA

Invasive medical care results in substantial physical and psychological stress to patients. The reported incidence of PTSD after medical care delivery in patients treated for trauma, cancer, and organ transplantation ranges from 5% to 51%. Similar data after elective lumbar spinal arthrodesis have not been reported.

METHODS

A consecutive series of 73 elective lumbar spine arthrodesis patients were evaluated prospectively, using the PTSD checklist-civilian version at 6 weeks, 3 months, 6 months, 9 months, and 12 months after surgery. Patient's sex, age, education level, job status, marital status, psychiatric history, prior surgery with general anesthetic, surgical approach, blood loss, postoperative intubation, length of intensive care unit and hospital stay, and occurrence of perioperative complications were analyzed as predictors of PTSD symptoms, using χ^2 analyses.

RESULTS

The overall incidence of symptoms of PTSD identified at at least 1 time point was 19.2% (14 of 73). At each time point, the percentage of the population that was positive was 7.5% (6 wk), 11.6% (3 mo), 7.8% (6 mo), 13.6% (9 mo), and 11.0% (12 mo). The presence of a prior psychiatric diagnosis proved to be the strongest predictor of postarthrodesis symptoms of PTSD (odds ratio [OR]

= 7.05, P = 0.002). Occurrence of a complication also proved to be significantly correlated with the development of PTSD symptoms (OR = 4.33, P = 0.04). Age less than 50 years, blood loss of more than 1 L, hospital stay of more than 10 days, and diagnosis trended toward but failed to reach statistical significance. None of the remaining variables approached statistical significance.

CONCLUSION

Positive PTSD symptoms occurred at least once in 19.2% of patients after elective lumbar arthrodesis, with 7.5% to 13.6% of patients experiencing these symptoms at any 1 time point postoperatively. In this patient cohort, preoperative psychiatric diagnosis was the strongest predictor among tested variables of occurrence of PTSD symptoms, although occurrence of a perioperative complication was also significantly correlated with PTSD symptoms. Spine surgeons should be aware of the potential impact of lumbar arthrodesis surgery on patients' psychological state. Further investigation focusing on the impact of PTSD symptoms on clinical outcomes as well as on potential means of reducing the postoperative incidence of this disorder seems warranted.

Research – Published Articles

Dynamic changes of the pelvis and spine are key to predicting postoperative sagittal alignment after pedicle subtraction osteotomy: a critical analysis of preoperative planning techniques. Smith JS; Bess S; Shaffrey CI; Burton DC; Hart RA; Hostin R; Klineberg E; International Spine Study Group. *Spine* (Phila Pa 1976). 2012;37:845-53.

STUDY DESIGN

Retrospective, radiographical analysis of mathematical formulas used to predict sagittal vertical axis (SVA) after pedicle subtraction osteotomy (PSO).

OBJECTIVE

Evaluate the ability of different formulas to predict SVA after PSO.

SUMMARY OF BACKGROUND DATA

Failure to achieve optimal spinal alignment after spinal fusion correlates with poor outcomes. Numerous mathematical models have been proposed to aid preoperative PSO planning and predict postoperative SVA. Pelvic parameters have been shown to impact spinal alignment; however, many preoperative planning models fail to evaluate these. Compensatory changes within unfused spinal segments have also been shown to impact SVA. Predictive formulas that do not evaluate pelvic parameters and unfused spinal segments may erroneously guide PSO surgery. A formula that integrates pelvic tilt (PT) and spinal compensatory changes to predict optimal SVA has been previously proposed.

METHODS

Comparative analysis of 5 mathematical models used to predict optimal postoperative SVA (<5 cm) after PSO was performed using a multicenter PSO database.

RESULTS

Radiographs of 147 patients, mean age 52 years ($SD = 15$ yr), who received 147 PSOs (42 thoracic and 105 lumbar) were evaluated. Mean preoperative and postoperative SVA was 108 mm ($SD = 95$ mm) and 30 mm ($SD = 60$ mm; $P < 0.001$), respectively. Each mathematical formula provided unique

prediction for postoperative SA (Pearson $R < 0.15$). Formulas that neglected pelvic alignment poorly predicted final SVA and poorly correlated with optimal SVA. Formulas that evaluated pelvic morphology (pelvic incidence) had improved SVA prediction. The Lafage formulas, which incorporate PT and spinal compensatory changes, had the best SVA prediction ($P < 0.05$) and best correlation with optimal SVA ($R = 0.75$).

CONCLUSION

Preoperative planning for PSO is essential to optimize postoperative spinal alignment. Mathematical models that do not consider pelvic parameters and changes in unfused spinal segments poorly predict optimal postoperative alignment and may predispose to poor clinical outcomes. The Lafage formulas, which incorporated PT and spinal compensatory changes, best predicted optimal SVA.

Changes in thoracic kyphosis negatively impact sagittal alignment after lumbar pedicle subtraction osteotomy: a comprehensive radiographic analysis. Lafage V; Ames C; Schwab F; Klineberg E; Akbarnia B; Smith J; Boachie-Adjei O; Burton D; Hart R; Hostin R; Shaffrey C; Wood K; Bess S; International Spine Study Group. *Spine (Phila Pa 1976)*. 2012;37:E180-7.

STUDY DESIGN

Consecutive, multicenter retrospective review.

OBJECTIVE

To evaluate if change in thoracic kyphosis (TK) has a positive or negative impact on spinopelvic alignment after lumbar pedicle subtraction osteotomy (PSO) with short fusions.

SUMMARY OF BACKGROUND DATA

In the setting of sagittal malalignment, the effect of large vertebral resections can now be anticipated in long fusions, but their impact on unfused segments (reciprocal changes [RC]) remains poorly understood.

METHODS

A total of 34 adult patients (mean age = 54 years; SD = 12) who underwent lumbar PSO with upper instrumented vertebra below T10 were included. Radiographic analysis included pre- and postassessment of TK, lumbar lordosis (LL), sagittal vertical axis (SVA), T1 spinopelvic inclination (T1SPI), pelvic tilt (PT), and pelvic incidence (PI). Final SVA and PT were analyzed to determine successful realignment. RC in the thoracic spine was designated favorable or unfavorable on the basis of impact on final SVA and PT.

RESULTS

Mean PSO resection was 26°. LL increased from 20° to 49° ($P < 0.001$). SVA improved from 14 to 4 cm ($P < 0.001$), and PT improved from 33° to 25° ($P < 0.001$). Mean increase in TK was 13° ($P = 0.002$) but was unchanged in 11 patients. Five patients had a favorable RC, and 18 patients had an unfavorable RC. Unfavorable RC was attributed to junctional failure in 6 of 18 patients. Significant differences in

the unfavorable RC group included age and greater preoperative PT, PI, SVA, and T1SPI.

CONCLUSION

Significant postoperative alignment changes can occur through unfused thoracic spinal segments after lumbar PSO. Unfavorable RC may limit optimal correction and lead to clinical failures. Risk factors for unfavorable thoracic RC include older patients, larger preoperative PI and PT, and worse preoperative T1SPI and are not simply due to junctional failure. Care should be taken with selective lumbar fusion and PSO in older patients and in those with severe preoperative spinopelvic parameters.

Sagittal realignment failures following pedicle subtraction osteotomy surgery: are we doing enough? Schwab F; Patel A; Shaffrey CI; Smith JS; Farcy JP; Boachie-Adjei O; Hostin R; Hart RA; Akbarnia B; Burton DC; Bess S; Lafage V. *J Neurosurg Spine*. 2012;16:539-46.

OBJECTIVE

Pedicle subtraction osteotomy (PSO) is a surgical procedure that is frequently performed on patients with sagittal spinopelvic malalignment. Although it allows for substantial spinopelvic realignment, suboptimal realignment outcomes have been reported in up to 33% of patients. The authors' objective in the present study was to identify differences in radiographic profiles and surgical procedures between patients achieving successful versus failed spinopelvic realignment following PSO.

METHODS

This study is a multicenter retrospective consecutive PSO case series. The authors evaluated 99 cases involving patients who underwent PSO for sagittal spinopelvic malalignment. Because precise cutoffs of acceptable residual postoperative sagittal vertical axis (SVA) values have not been well defined, comparisons were focused between patient groups with a postoperative SVA that could be clearly considered either a success or a failure. Only cases in which the patients had a postoperative SVA of less than 50 mm (successful PSO realignment) or more than 100 mm (failed PSO realignment) were included in the analysis. Radiographic measures and PSO parameters were compared between successful and failed PSO realignments.

RESULTS

Seventy-nine patients met the inclusion criteria. Successful realignment was achieved in 61 patients (77%), while realignment failed in 18 (23%). Patients with failed realignment had larger preoperative SVA (mean 217.9 vs 106.7 mm, $p < 0.01$), larger pelvic tilt (mean 36.9° vs 30.7°, $p < 0.01$), larger pelvic incidence (mean 64.2° vs 53.7°, $p < 0.01$), and greater lumbar lordosis–pelvic incidence mismatch (-47.1° vs -30.9° , $p < 0.01$) compared with those

in whom realignment was successful. Failed and successful realignments were similar regarding the vertebral level of the PSO, the median size of wedge resection 22.0° (interquartile range 16.5°–28.5°), and the numerical changes in pre- and postoperative spinopelvic parameters ($p > 0.05$).

CONCLUSIONS

Patients with failed PSO realignments had significantly larger preoperative spinopelvic deformity than patients in whom realignment was successful. Despite their apparent need for greater correction, the patients in the failed realignment group only received the same amount of correction as those in the successfully realigned patients. A single-level standard PSO may not achieve optimal outcome in patients with high preoperative spinopelvic sagittal malalignment. Patients with large spinopelvic deformities should receive larger osteotomies or additional corrective procedures beyond PSOs to avoid undercorrection.

Multicenter validation of a formula predicting postoperative spinopelvic alignment.

Lafage V; Bharucha NJ; Schwab F; Hart RA; Burton D; Boachie-Adjei O; Smith JS; Hostin R; Shaffrey C; Gupta M; Akbarnia BA; Bess S. *J Neurosurg Spine*. 2012;16:15-21.

OBJECTIVE

Sagittal spinopelvic imbalance is a major contributor to pain and disability for patients with adult spinal deformity (ASD). Preoperative planning is essential for pedicle subtraction osteotomy (PSO) candidates; however, current methods are often inaccurate because no formula to date predicts both postoperative sagittal balance and pelvic alignment. The authors of this study aimed to evaluate the accuracy of 2 novel formulas in predicting postoperative spinopelvic alignment after PSO.

METHODS

This study is a multicenter retrospective consecutive PSO case series. Adults with spinal deformity (> 21 years old) who were treated with a single-level lumbar PSO for sagittal imbalance were evaluated. All patients underwent preoperative and a minimum of 6-month postoperative radiography. Two novel formulas were used to predict the postoperative spinopelvic alignment. The results predicted by the formulas were then compared with the actual postoperative radiographic values, and the formulas' ability to identify successful (sagittal vertical axis [SVA] \leq 50 mm and pelvic tilt [PT] \leq 25°) and unsuccessful (SVA > 50 mm or PT > 25°) outcomes was evaluated.

RESULTS

Ninety-nine patients met inclusion criteria. The median absolute error between the predicted and actual PT was 4.1° (interquartile range 2.0°-6.4°). The median absolute error between the predicted and actual SVA was 27 mm (interquartile range 11-47 mm). Forty-one of 54 patients with a formula that predicted a successful outcome had a successful outcome as shown by radiography (positive predictive value = 0.76). Forty-four of 45 patients

with a formula that predicted an unsuccessful outcome had an unsuccessful outcome as shown by radiography (negative predictive value = 0.98).

CONCLUSIONS

The spinopelvic alignment formulas were accurate when predicting unsuccessful outcomes but less reliable when predicting successful outcomes. The preoperative surgical plan should be altered if an unsuccessful result is predicted. However, even after obtaining a predicted successful outcome, surgeons should ensure that the predicted values are not too close to unsuccessful values and should identify other variables that may affect alignment. In the near future, it is anticipated that the use of these formulas will lead to better surgical planning and improved outcomes for patients with complex ASD.

Research – Published Articles

Acetabular retroversion in post slipped capital femoral epiphysis deformity. Bauer JP; Roy DR; Thomas SS. *Journal of Children's Orthopaedics.* 2013;7:91-4.

PURPOSE

While the femoral deformity in post Slipped Capital Femoral Epiphysis (SCFE) hips has been implicated in the development of Femoral Acetabular Impingement (FAI), little has been studied about the acetabular side. The purpose of our study was to determine the frequency of morphologic changes suggestive of acetabular retroversion present in patients who have sustained a SCFE.

METHODS

IRB approval was obtained and the records of patients from 1975 to 2010 were searched for ICD-9 codes for SCFE. A total of 188 patients were identified for the study. Two observers evaluated AP radiographs for evidence of acetabular retroversion as characterized by the presence of either an ischial spine sign or a cross over sign. Demographic data, date of onset and treatment were recorded. For analysis, the right hip was used in patients with bilateral involvement.

RESULTS

Of the 188 patients identified, 5 patients had an incorrect diagnosis and 41 patients had missing or inadequate films, leaving 142 patients (284 hips) for review. 57 patients (114 hips) had bilateral SCFE and 85 patients had unilateral SCFE. 79% (n=45) of the right hips with bilateral SCFE and 82% (n=70) of unilateral involved hips had at least one sign of retroversion. Uninvolved hips had at least one sign of retroversion 76% (n=65) of the time.

CONCLUSIONS

When compared to previously published values for normal patients, those affected with SCFE appear to have an increased incidence of acetabular retroversion.

Research – Published Articles

Metatarsophalangeal joint pathology in crossover second toe deformity: a cadaveric study. Coughlin MJ; Schutt SA; Hirose CB; Kennedy MJ; Grebing BR; Smith BW; Cooper MT; Golano P; Viladot R; Alvarez F. *Foot Ankle Int.* 2012;33:133-40.

BACKGROUND

Ligamentous and capsular insufficiency of the second metatarsophalangeal joint has been surgically treated for over two decades, mainly with indirect surgical repairs, which stabilize adjacent soft tissue and shorten or decompress the osseous structures. While ligamentous insufficiency has been described and recognized, degeneration of the plantar plate and tears of the capsule have rarely been documented. The purpose of this study was to document and describe the presence and pattern of plantar plate tears in specimens with crossover second toe deformities, and based on this, to develop an anatomical grading system to assist in the assessment and treatment of this condition.

METHODS

Sixteen below-knee cadaveric specimens with a clinical diagnosis of a second crossover toe deformity were examined, and dissected by removing the metatarsal head. The pathologic findings of plantar plate and capsular pathology, as well as ligamentous disruption, were observed and recorded. Demographics of the specimens were recorded, and simulated weightbearing radiographs were obtained prior to dissection so that pertinent angular measurements could be obtained.

RESULTS

Demographics demonstrated a high percentage of female specimens, and a typically older population that has been reported for this condition. Radiographic findings documented a high percentage of hallux valgus and hallux rigidus deformities. The MTP-2 and MTP-3 angles were divergent consistent with a crossover toe deformity. We consistently found transverse tears in the plantar plate region immediately proximal to

the capsular insertion on the base of the proximal phalanx. With increasing deformity, wider distal transverse tears extending from lateral to medial were found. Midsubstance tears, collateral ligament tears, and complete disruption of the plantar plate were found in more severe deformities.

CONCLUSION

In this largest series of cadaveric dissections of crossover second toe deformities, we describe the types and extent of plantar plate tears associated with increasing deformity of the second ray. We present, based on these findings, an anatomic grading system to describe the progressive anatomic changes in the plantar plate.

Research – Published Articles

Does double-row rotator cuff repair improve functional outcome of patients compared with single-row technique? A systematic review. DeHaan AM; Axelrad TW; Kaye E; Silvestri L; Puskas B; Foster TE. *Am J Sports Med.* 2012;40: 1176-85.

BACKGROUND

The advantage of single-row versus double-row arthroscopic rotator cuff repair techniques has been a controversial issue in sports medicine and shoulder surgery. There is biomechanical evidence that double-row techniques are superior to single-row techniques; however, there is no clinical evidence that the double-row technique provides an improved functional outcome.

HYPOTHESIS

When compared with single-row rotator cuff repair, double-row fixation, although biomechanically superior, has no clinical benefit with respect to retear rate or improved functional outcome.

STUDY DESIGN

Systematic review.

METHODS

The authors reviewed prospective studies of level I or II clinical evidence that compared the efficacy of single- and double-row rotator cuff repairs. Functional outcome scores included the American Shoulder and Elbow Surgeons (ASES) shoulder scale, the Constant shoulder score, and the University of California, Los Angeles (UCLA) shoulder rating scale. Radiographic failures and complications were also analyzed. A test of heterogeneity for patient demographics was also performed to determine if there were differences in the patient profiles across the included studies.

RESULTS

Seven studies fulfilled our inclusion criteria. The test of heterogeneity across these studies showed no differences. The functional ASES, Constant, and UCLA outcome scores revealed no difference between single- and double-row rotator cuff

repairs. The total retear rate, which included both complete and partial retears, was 43.1% for the single-row repair and 27.2% for the double-row repair ($P = .057$), representing a trend toward higher failures in the single-row group.

CONCLUSION

Through a comprehensive literature search and meta-analysis of current arthroscopic rotator cuff repairs, we found that the single-row repairs did not differ from the double-row repairs in functional outcome scores. The double-row repairs revealed a trend toward a lower radiographic proven retear rate, although the data did not reach statistical significance. There may be a concerning trend toward higher retear rates in patients undergoing a single-row repair, but further studies are required.

Research – Published Articles

Late reconstruction of median nerve palsy. Ko JW; Mirarchi AJ. *Orthop Clin North Am.* 2012;43:449-57.

ABSTRACT

The median nerve provides sensory innervation to the radial aspect of the hand, including the palm, thumb, index, long, and half of the ring fingers. It provides motor innervation to most of the volar forearm musculature and, importantly, to most of the thenar musculature. The main goal of median nerve reconstructive procedures is to restore thumb opposition. There are a variety of transfers that can achieve this goal but tendon transfers must recreate thumb opposition, which involves 3 basic movements: thumb abduction, flexion, and pronation. Many tendon transfers exist and the choice of tendon transfer should be tailored to the patient's needs.

AAOS 2013 Annual Meeting Presentations and Activities

Presence of OHSU Department of Orthopaedics & Rehabilitation

PODIUM PRESENTATIONS

An Autologous Chondrocyte Tissue Implant (ACTI) for the Treatment of Chondral Defects in the Femur: Mid-term Results. **Dennis C. Crawford, MD, Thomas M. DeBerardino, MD, Claude T. Moorman III, MD, Dean C. Taylor, COL, MD, ChunBong B. MD, James C. Chesnutt, MD, Bradley J. Nelson, MD, Riley J. Williams, MD**

The Thoracolumbar Fusion Risk Score: Predicting Postoperative Morbidity and Mortality. **Jacqueline Munch, MD, Natalie L. Zusman, BS, Elizabeth Lieberman, BS, Ryland Stucke, BS, Sawyer G. Smith, BS, Courtney D. Bell, BS, Travis Philipp, BA, Alexander C. Ching, MD, Jung U. Yoo, MD**

Spinal Stenosis with Lumbar Deformity: Surgical Failures with an ISP, Laminectomy, or Laminectomy and Fusion. Prokopis Annis, MD, Michael D. Daubs, MD, Brandon Lawrence, MD, Justin Hohl, MD, **Jayne Hiratzka, MD, Darrel S. Brodke, MD**

Clinical Improvement Through Surgery for Adult Spinal Deformity (ASD): Who is Likely to Benefit Most? Bertrand Moal, MS, Frank J. Schwab, MD, Christopher Ames, MD, Justin S. Smith, MD, Jamie S. Terran, BS, **Robert A. Hart, MD, Christopher I. Shaffrey, MD, Virginie Lafage, PhD**

Health Impact Comparison of Different Disease States and Population norms to Adult Spinal Deformity. Kaiming G. Fu, MD, PhD, Robert S. Bess, MD, Frank J. Schwab, MD, Christopher I. Shaffrey, MD, Virginie Lafage, PhD, Douglas C. Burton, MD, **Robert A. Hart, MD, Praveen V. Mummaneni**

Are Multiple Cultures Worth the Effort? Impact on Hip and Knee Revision Arthroplasty. **Alexander DeHaan, MD, Michael Kuhne, MD, Yee-Cheen Doung, MD, James B. Hayden, MD, Thomas Huff, MD, Penelope Barnes, MBBS, PhD, Kathryn Schabel, MD**

POSTER PRESENTATIONS

Multiple and Prolonged Cultures During Shoulder and Elbow Revision Arthroplasty: Impact on Antibiotic Treatment. **Alexander DeHaan, MD, Zachary Domont, MD, Michael Kuhne, MD, Adam Mirarchi, MD, Penelope Barnes, MBBS, PhD, Robert M. Orfaly, MD**

The Impact of Multiple Cultures on Antibiotic Usage: A Protocol for Nonunion and Hardware Infections. **Michael Kuhne, MD, Joseph Volpi, BS, Penelope Barnes, MBBS, PhD, Darin M. Friess, MD**

Reconstruction of a Bony Bankart Lesion: Best Fit Based on Radius of Curvature. **Alexander DeHaan, MD, Jacqueline Munch, MD, Michael Durkan, BS, Jung U. Yoo, MD, Dennis C. Crawford, MD**

Primary Versus Revision Surgery: Multi-Center Analysis of Outcomes Following Surgery for Adult Spinal Deformity. Khaled M. Kebaish, MD, Eric O. Klineberg, MD, Mostafa H. El Dafrawy, MD, Christopher Ames, MD, Shay S. Bess, MD, Vedat Deviren, MD, **Robert A. Hart, MD, Munish C. Gupta, MD**

The Effect of Sagittal Plane Correction on Cervical Spine Alignment. **Jayne Hiratzka, MD, Michael D. Daubs, MD, Prokopis Annis, MD, Justin Hohl, MD, Brandon Lawrence, MD, Darrel S. Brodke, MD**

Age, Sagittal Balance and Operative Correction are Risk Factors for Proximal Junctional Failure in Adult Deformity. **Robert A. Hart, MD, Richard A. Hostin, MD, Robert S. Bess, MD, Frank J. Schwab, MD, Virginie Lafage, PhD, Praveen V. Mummaneni, Christopher Ames, MD, Justin S. Smith, MD, Oheneba Boachie-Adjei, MD**

INSTRUCTIONAL COURSES

Shoulder and Elbow Review Course. **Moderator:** **Robert M. Orfaly, MD**, Carl Basamania, MD, Lana Kang, MD, John W. Sperling, MD, MBA

Recording and Reporting of Adverse Outcomes in Spine Surgery: Are We at the Top of Our game?

Moderator: **Robert A. Hart, MD**, Paul A. Anderson, MD, Eugene Carragee, MD, Sohail K. Mirza, MD

Is This Article Going to Change My Practice? A Critical Evaluation of Literature. **Moderator:** **Amer J. Mirza, MD**, **Richard Myers, MD**, Jaimo Ahn, MD

The Current State of Minimally Invasive Spine Surgery. **Moderator:** **Alexander C. Ching, MD**, Mark B. Dekutoski, MD, Eugene Y. Koh, MD, PhD, Gregory M. Mundis, MD

Humeral Shaft Fractures: Is Nonoperative Treatment Still an Option? **Moderator:** **Amer J. Mirza, MD**, Erik Kubiak, MD, **Matthew D. McElvany, MD**, Samir Mehta, MD

Magnetic Resonance Imaging of the Knee and Shoulder. **Moderator:** **Dennis C. Crawford, MD**, Lynne S. Steinbach, MD, Carl S. Winalski, MD

Adult Lumbar Disc Herniation: Treatment, Complications, Outcomes and Evidence Based Data for Patient and Health Professional Counseling. Moderator: Robert S. Bess, MD, Douglas C. Burton, MD, **Alexander C. Ching, MD**, Eric O. Klineberg, MD

Perspectives on Mentorship. **Moderator:** **Robert A. Hart, MD**, James H. Beaty, MD, Edward N. Hanley Jr, MD, Vernon T. Tolo, MD

SYMPOSIA / COMMITTEE INVOLVEMENT

2013 Central Instructional Course Committee.

Robert A. Hart, MD, Chair, Craig J. Della Valle, MD, Mark W. Pagnano, MD, Thomas W. Throckmorton, MD, Paul Tornetta III, MD, Dempsey S. Springfield, MD, Ex-Officio

Award Program OVT02: Index Finger Ray Resection.

Robert M. Orfaly, MD

Trauma I: Ankle and Pilon. **Moderator(s): Amer J.**

Mirza, MD, Ivan S. Tarkin, MD

Spine VI: Basic Science and Miscellaneous.

Moderator(s): Robert A. Hart, MD, Ahmad Nassr, MD

Board of Councillors Annual Business Meeting.

Robert M. Orfaly, MD

Leadership Fellows Program.

Robert M. Orfaly, MD

SYMPOSIUM (E): Translational Research in Orthopaedics: Structural Bone Allograft from Benchtop to Bedside. **Moderator:** **Robert A. Hart, MD**

Section V. Clinical Applications of Allograft Bone in Spinal Fusion. **Robert A. Hart, MD**

Ambulatory brachial plexus catheter (home pump) for early postoperative pain management in operatively treated distal radius fractures. Young A; Horn J; Mirarchi A.

PURPOSE

Our purpose is to report on patient satisfaction with the use of indwelling brachial plexus perineurial catheter and home infusion pump ("home pump") among adult patients treated operatively for distal radius fractures.

METHODS

We retrieved and abstracted existing medical records for 23 adult patients who underwent operative distal radius fracture treatment. Information was abstracted from the medical record regarding neurological function, daily pain level on a scale of 0-10, catheter site condition, ambulation, narcotic use, pump settings, and overall patient experience, which had been recorded via phone interview on post-operative days 1 through 5.

RESULTS

Ten men and 13 women aged of 23 to 76 years were included. Most catheters were placed successfully on the first attempt. The mean postoperative pain score at rest was 4 and with movement was 5. Leaking at the catheter insertion site on at least one day was reported by 5 patients (22%). Most (22/23 patients) patients reported 'good' or 'excellent' daily assessment of pain relief. Post operatively, 95% reported normal ambulation. Forty-seven percent reported being 'satisfied' and 53% reported being 'very satisfied' (53%) with the home pump. Ninety-three percent reported that they would recommend the home pump to a friend or family member undergoing similar treatment. None developed acute compartment syndrome, undetected carpal tunnel syndrome or other adverse effects during catheter infusion.

CONCLUSIONS

In this study, home pumps appeared to provide effective postoperative analgesia among adult patients recovering from distal radius fracture repair. All home pumps were well tolerated and with high overall patient satisfaction. No harmful effects on patient ambulation were noted and no evidence of neurologic injury or vascular compromise presenting postoperatively was masked by use of the home pump.

Incidence and treatment trends for periprosthetic fractures about total knee arthroplasty: Analysis of The Nationwide Inpatient Sample Database. Roster B; DeHart M; Mirza A.

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

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

	2006	2007	2008	2009	2010
# OF ADMISSIONS	2753	3770	4575	3027	3385
# OF FRACTURES	3147	4284	5200	3576	3749

types of procedures performed during these admissions. Procedures were subclassified as closed treatment, open treatment with internal fixation, and revision arthroplasty procedures.

RESULTS

A total of 17,510 inpatient admissions were identified between the years 2006-2010 comprising our study group. We identified a total of 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). The overall inpatient mortality rate was very low (0.012%, n=207).

at 65% of all procedures from 2006-2010. Revision arthroplasty procedures increased from 19.6% in 2006 to 30.3% in 2010.

CONCLUSION

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.

Ulnar neuropathy following surgical fixation of a displaced olecranon fracture.

Natarajan V; Mirarchi AJ; Amer J; Mirza AJ.

Ulnar nerve entrapment at the elbow is the second most common nerve entrapment syndrome. Olecranon fractures and other elbow fractures may be associated with acute or delayed ulnar neuropathy. However, there are no previously documented cases of acute compression of the ulnar nerve following surgical fixation of an olecranon fracture.

We present the case of a 46 year-old woman who developed an acute ulnar neuropathy following such an operation. She had previously not exhibited any signs of ulnar nerve compression prior to undergoing surgery. In the immediate post-operative period, she rapidly developed symptoms consistent with compression of the nerve, and was brought back to the operating room for re-exploration. The nerve was found to be constricted under the fascia of the flexor carpi ulnaris muscle. There was also a hematoma present within the cubital tunnel, which was subsequently evacuated. Immediately upon awakening following this surgery, the patient noted near-complete resolution of her symptoms, and has not had recurrence of her ulnar neuropathy since that time.

This case is, to the best of our knowledge, the first known example of acute ulnar nerve compression following surgical fixation of an olecranon fracture. The prompt recognition of the condition by the surgeon and immediate intervention led to complete resolution of the patient's symptoms. This case illustrates the importance of careful post-operative monitoring in diagnosing and treating this rare but dangerous complication.

Research – Articles in Progress

Cost analysis of orthopaedic CME. Kennedy C; Friess D.

Certification by the American Board of Orthopaedic Surgery requires that orthopaedic surgeons certified in 1986 and thereafter maintain certification by participating in a series of educational activities in a ten-year cycle. There are various routes by which Category 1 CME credits may be obtained, including medical society meetings, medical school events, journals, industry sponsored events, and private companies. While cost-free credits exist, there is often significant cost related to obtaining credits.

The objective of this paper is, through an internet search, to compare the costs of venues for obtaining orthopaedic-related CME credits. Our search revealed that significant variation exists in both the cost of orthopaedic-related CME credit offerings as well as the cost per credit. The purpose of this paper is not to question the utility of CME, but rather to point out the substantial costs associated with common methods of obtaining orthopaedic-related CME credits.

CME Credit Source	# CME Credit	Avg Cost	Cost per Credit
AAOS Self-Assessment 3-Exam <i>Online</i>	30 -35	\$219	\$6.70
AAOS Orthopaedic Knowledge Update 10	70	\$309	\$4.41
Orthopaedic In-Training Exam	20	\$99	\$4.95
Practical Reviews	56	\$349	\$6.23
The Oakstone Institute Comprehensive Review	31.5	\$1,100	\$34.76
Primary Care Orthopaedics	14.75	\$650	\$43.72
Musculoskeletal MRI	12.5	\$895	\$71.60
Penn Radiology ENT, Neuro, and MSK Imaging	22	\$495	\$22.50
Audio-Digest Orthopaedics	~5	\$425	\$9.50
MedRisk Online Course: Risk Management	5	\$75	\$15
Medscape Education Orthopaedics	~1	0	0
Healio Orthopedics Education Lab/CME	~1	\$15	\$15
The Journal of Bone & Joint Surgery (JBJS) CME	10/quarter	\$85/quarter	
Orthopaedic Knowledge Online Journal (OKOJ)	2	\$40	\$20
OHSU Orthopaedics Grand Rounds	2/month	0	0
Emerging Techniques in Orthopedics meeting	30	\$1,050	\$200
Oregon Association of Orthopaedists meeting	11	\$395	\$36
AAOS 2013 Annual Meeting, Chicago, IL	39	varies	varies

Treatment of comminuted pilon fractures with immediate ankle arthrodesis.

Beaman D; Komlofske K; Gellman R.

PURPOSE

To determine if immediate ankle arthrodesis is a viable treatment for highly comminuted pilon fractures.

METHODS

Eleven patients (12 ankles) with highly comminuted ankle pilon fractures were counseled to undergo ankle arthrodesis as their initial boney stabilization rather than standard open reduction and internal fixation based on the comminution seen on preoperative CT scan and/or during initial debridement for open fracture. 11/12 ankles were treated with spanning external fixation initially. Fractures extended into the tibial shaft in 9/12.

RESULTS

See table 1 for details. Of note, patient 12 with 2.5 cm of bone loss required gradual shortening and wound management prior to fusion at 67 days post injury.

Complications included a superficial wound dehiscence that required debridement and skin grafting and an occult nonunion at the level of the tibial shaft that required bone grafting and revision of the internal fixation. There were no deep infections.

CONCLUSION

Immediate ankle arthrodesis is a viable treatment for highly comminuted ankle pilon fractures with high union rates.

Table 1: Results of Immediate Ankle Arthrodesis

Ankle	Age/ Sex	Open Injury	Time To Operation	Ilizarov Fixation	Plate Fixation	Bone Graft	Time to Union	Time to Last Follow-Up	AOFAS Score
1	60/M	Y	21 days	No	Yes	Iliac Crest	3.75 mo.	8.5 mo.	81
2	76/M	N	10 days	No	Yes	Allograft	3 mo.	6 mo.	91
3	45/F	N	21 days	No	Yes	Allograft	4 mo.	20 mo.	87
4^	25/M	Y	10 days	Yes	Yes	Allograft	4.5 mo.	-	-
5	55/F	Y	14 days	Yes	No	Allograft	3.75 mo.	11 mo.	n/a
6	51/M	N	17 days	Yes	Yes	Allograft	5 mo.	17 mo.	82
7	66/M	Y	14 days	Yes	Yes	Allograft	3 mo.	7.5 mo.	91
8**	56/M	N	17 days	Yes	Yes	Allograft	5 mo.	6 mo.	n/a
9**	56/M	N	17 days	Yes	Yes	Allograft	5 mo.	6 mo.	n/a
10	42/M	N	8 days	Yes	Yes	Allograft	4 mo.	22 mo.	82
11	33/F	N	24 days	Yes	Yes	Allograft	3.5 mo.	19.5 mo.	87
12*	66/F	Y	67 days	Yes	No	Allograft + Local Autograft	3.75 mo.	20 mo.	69

Avg	52.6 y (25-76)	15.7 days (8-24)			4 months (3-5)	14 months (6-22)	83 (69-91)
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* = not included in average time to fusion operation, see results section for discussion

** = same patient (bilateral injury)

^ = patient deceased before follow-up not related to surgical or medical factors

Multiple and prolonged cultures during shoulder and elbow revision arthroplasty: impact on clinical care. DeHaan A; Domont Z; Mirarchi A; Orfaly R; Barnes P.

INTRODUCTION/METHODS

Skin flora organisms (SFOs) isolated from 1 or 2 biopsies during shoulder and elbow revision arthroplasty are difficult to distinguish as contamination or infection. This study examined the change in microbiological diagnosis and resultant antibiotic treatment when the number of intra-operative biopsies held for prolonged 10 day anaerobic incubation was increased from 1-2 to 5 or more. Coagulase negative Staphylococcus, Corynebacteria and Propionibacteria were defined as skin flora organisms. Infection was defined as ≥ 3 biopsies growing the same SFO, or any positive biopsy with a virulent organism. 1-2 biopsies growing SFOs were defined as contaminant.

Poster Presentation, American Academy of Orthopaedic Surgeons (AAOS) 2013 Annual Meeting
Poster Presentation, American Orthopaedic Association 126th National Meeting, June 2013
Manuscript in process

RESULTS

Forty cases in 33 patients were retrospectively reviewed over a 15-month period. When compared to the standard of only obtaining one culture, this protocol altered the microbiological diagnosis and antibiotic management in 18/40 cases (45%; 95% CI: 29-62%). Cultures of Propionibacteria accounted for 9 of the 10 cases of infection attributed to SFO pathogens, and in 5 of the 11 cases defined as SFO contaminant. Additionally, joint sterility was predicted in 14 of 15 culture negative cases (93%; 95% CI: 68-99%) with more than one year follow-up.

CONCLUSION

The addition of 5 or more biopsies held for prolonged incubation appeared to successfully help differentiate between joint infection, contamination, and sterility. The protocol has been continued at our institution.

Multiple cultures and extended incubation for hip and knee revision arthroplasty: impact on clinical care. DeHaan A; Huff T; Schabel K; Doung YC; Hayden J; Barnes P.

INTRODUCTION/METHODS

Skin flora organisms (SFOs) isolated from 1 or 2 biopsies during hip and knee revision arthroplasty are difficult to distinguish as contamination or infection. This study examined the change in microbiological diagnosis and resultant antibiotic treatment when the number of intra-operative tissue cultures held for prolonged 10 day anaerobic incubation was increased from 1-2 to 5 or more. Coagulase negative Staphylococcus, Corynebacteria and Propionibacteria were defined as skin flora organisms. Infection was defined as ≥ 3 biopsies growing the same SFO, or any positive biopsy with a virulent organism. 1-2 biopsies growing SFOs were defined as contaminant.

RESULTS

Seventy-seven cases in 73 patients were retrospectively reviewed over a 15-month period, all with more than 1 year of clinical follow-up. 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 95% predictive value of joint sterility in culture negative cases (95% CI: 85-99%).

CONCLUSION

The addition of 5 or more tissue biopsies held for prolonged incubation appeared to be a powerful tool to help differentiate between joint infection, contamination, and sterility. The protocol has been continued at our institution.

Podium Presentation, American Academy of Hip and Knee Surgeons (AAHKS) 2012 Annual Meeting

Podium Presentation, American Academy of Orthopaedic Surgeons (AAOS) 2013 Annual Meeting

Accepted for publication, Journal of Arthroplasty

Role of gender on the diagnosis, prevalence, and effect of depression in cervical spine surgery patients. Myers RJ; Zusman N; Larsen S; Ching AC; Hart RA; Yoo JU.

PURPOSE

Psychological conditions impact surgery results, but the prevalence and risk factors associated with depression in spine patients have not been fully explored.

METHODS

Retrospective analysis of 272 cervical surgery patients from 2007-2011 with preoperative patient-reported outcome measures (SF-12 MCS & PCS) and demographic data. Depression was defined as MCS ≤ 45 or as a preoperative diagnosis.

RESULTS By diagnosis, 32% of patients were

depressed, and females were 2.6 times more likely to carry the diagnosis (42% vs. 16%, $p<0.01$). When depression = MCS ≤ 45 , females and males were more likely to be depressed (50% vs. 36%, $p=0.03$). Males were less likely to be clinically diagnosed, despite an MCS score ≤ 45 (91% male vs. 71% female false negative proportion).

CONCLUSIONS

Cervical patients have a high prevalence of depression. Women have a higher prevalence of depression, but they may be more self-aware of the condition and are more frequently diagnosed.

	Not Depressed	Depressed (Chart diagnosis)	
Males	88	17 (16%)	
Females	97	70 (42%)	p<0.001
<hr/>			
	Not Depressed	Depressed (MCS ≤ 45)	
Males	67	38 (36%)	
Females	84	83 (50%)	p=0.0291
<hr/>			
Entire Cohort			
	MCS ≤ 45 (Depressed)	MCS > 45 (Not Depressed)	
Chart: Depressed	30	57	
Chart: Not Depressed	121	64	P<0.0001
<hr/>			
MALES			
	MCS ≤ 45 (Depressed)	MCS > 45 (Not Depressed)	
Chart: Depressed	6	11	
Chart: Not Depressed	61	27	p=0.0075
<hr/>			
FEMALES			
	MCS ≤ 45 (Depressed)	MCS > 45 (Not Depressed)	
Chart: Depressed	24	46	
Chart: Not Depressed	60	37	p=0.0004

A scoring system to predict postoperative medical complications in high-risk patients undergoing elective thoracic/lumbar arthrodesis.

Munch JL; Zusman NL; Lieberman EG; Stucke RS; Bell C; Philipp TC; Smith S; Ching AC; Hart RA; Yoo JU.

BACKGROUND

Various surgical factors affect the incidence of postoperative medical complications following elective spinal arthrodesis. Due to the complexity and inter-relatedness of these factors, it is difficult for clinicians to accurately risk stratify individual patients. We defined high-risk patients as those with American Society of Anesthesiologists (ASA) scores 3-4, and systematically examined our high-risk patients undergoing an elective thoracic/lumbar fusion to isolate important perioperative variables. Those risk factors were then used to develop a scoring system that predicts the rate of developing major medical complications.

METHODS

Our retrospective cohort study reviewed the clinical course of 281 patients with ASA 3-4 undergoing spine fusion surgeries between 2007 and 2011. Risk factors were recorded, and patients who suffered major medical complications within the 30-day postoperative period were identified. We used Chi-Square tests to determine the factors that affect the medical complication rate. The relevant factors were identified, ranked, and scored by quartiles. The quartile scores of the factors were combined to form a single composite score. We then determined the major medical complication rate for each composite score, and divided the cohort into quartiles again based on score. A Pearson linear regression analysis was used to compare the incidence of complications to the score.

RESULTS

The number of fused levels, operative time, volume of intraoperative fluids, and estimated blood loss (EBL) influenced the complication rate of ASA 3-4 patients. The LOVE (levels, operative time, volume of fluids, and EBL) score, determined by quartile

ranking of these four factors, predicted the complication rate in a linear fashion.

CONCLUSIONS

We identified four factors that contributed to the development of medical complications: number of fused levels, operative time, volume of intraoperative fluids, and EBL. Although these four factors are not independent of one another, taken together they proved to be strongly predictive of the major medical complication rate.

The impact of multiple cultures and prolonged incubation on microbiological diagnosis & resultant antibiotic usage in trauma patients. Kuhne M; Volpi J; Barnes P; Friess D.

BACKGROUND

This study examined changes in microbiological diagnosis and antibiotic treatment when the number of intra-operative biopsies was increased from 1 to ≥ 5 and incubation prolonged to 10 days in cases of presumed hardware infection and fracture non-union.

METHODS

Patient cohort was constructed from a 16 month retrospective chart review.

RESULTS

52 cases fulfilled inclusion criteria. In 21 cases, all biopsies were sterile. Multiple biopsies identified the virulent organism in 5 of 17 cases, skin flora organism (SFO) infection in 7 cases, and SFO contaminant in 2 patients. Microbiological diagnosis changed in 14/52 cases (27%) as compared to collecting a single biopsy. Antibiotic treatment was narrowed in 5 cases of virulent organism infection, 6 cases of SFO infection, and held in 2 cases of SFO contamination. Postoperative antibiotic management changed in 13/52 cases (25%).

CONCLUSION

5 or more biopsies increased diagnostic accuracy and altered antibiotic management in one quarter of cases.

Fixed angle polyaxial screw osteosynthesis for vertically unstable sacral fractures: A biomechanical comparison with iliosacral screws. Wierking D; Mirza A.

Pelvic ring disruptions involving vertical transforaminal sacral fracture patterns are particularly prone to late deformity and prolonged symptoms even after surgical fixation using standard iliosacral screw techniques. The current study sought to investigate if fixed angle screw osteosynthesis would resist displacement better than standard iliosacral screws for this fracture pattern.

10 synthetic pelvic bone models were divided into two groups after creation of a transforaminal sacral osteotomy. One group was fixed with standard iliosacral screws and the other with fixed angle screws of the same length in an identical trajectory. These specimens were then sequentially loaded to simulate postoperative weightbearing activity and the displacements were measured in each group.

There was a significant difference between the groups for both vertical displacement and rotational displacement at nearly all time points.

The present study demonstrates a statistically significant difference in displacement for iliosacral screws compared to fixed angle screws in this model of vertical transforaminal sacral fractures. However, the net displacements were quite small in both groups and further study is needed to determine if there is a clinical benefit to fixed angle fixation compared to multiple iliosacral screw fixation for these fractures.

Percutaneous plating of the distal femur: risk of injury to the perforating branches of the profunda femoris artery. Baker A; Roster B; Mirza A.

PURPOSE

The goal of this study was to map the anatomic course of the perforating branches of the profunda femoris artery and determine the risk of injury during percutaneous plate insertion along the lateral femoral shaft.

HYPOTHESIS

Percutaneous application of pre-contoured distal femur plates causes vascular injury to the perforating branches of the profunda femoris artery. There is an identifiable pattern of the perforating branches of the profunda femoris artery.

METHODS

37 adult fresh frozen cadaveric lower extremity specimens were instrumented with precontoured distal femoral periarticular plates. The specimens were dissected and the location, diameter, number, and course of the deep perforating arteries (PA) and their branches were noted with respect to the lateral femoral cortex and distance from the articular surface of the lateral femoral condyle. The incidence of perforating artery injury was determined and quantified with respect to plate hole number.

RESULTS

We found an approximately 80% injury rate to the perforating arteries if each hole is filled with application of pre-contoured distal femur periarticular plates. We also saw an average of 5, with a range 3-7, perforating branches off each profunda femoris artery. We determined the average diameter of the perforating arteries of the profunda femoris artery as follows (cm): PA1 .67, PA 2 .72, PA 3 1.04, PA 4 1.02, PA 5 .87 , PA 6 .69, PA 7 .84. The more proximal perforating arteries had fewer divisions than did the more distal perforating

arteries. We determined the average number of branches for each perforating artery while crossing the lateral femur, finding that 52% had 0 branches, 2% had 1 branch, 46% had 2 or more branches.

CONCLUSION

The deep perforating branches of the profunda femoris are at risk of injury during sub-muscular minimally invasive plating techniques for stabilization of distal femoral fractures. Our study demonstrated a consistent number and pattern of perforating branches of the profunda femoris artery. We noted an average of 80% injury rate to the perforating arteries or one of their branches with percutaneous insertion of screws. An understanding of the anatomical course of the profunda femoris perforating arteries can be used during minimally invasive plating techniques of the distal femur.

Popliteal artery injury associated with total knee arthroplasty: trends, costs, and risk factors. Matsen-Ko L; Huff T; Yoo J.

In this study using the Nationwide Inpatient Sample (NIS) from 1998-2009, we found that the length of stay and hospital charges associated with popliteal artery injury to be more than doubled in total knees in comparison with all-comer total knee arthroplasty. Vascular injury increased mortality by twenty times. The risk of injury with revision arthroplasty was more than two times increased compared to primary total knees. We found eighteen patient comorbidities to be significantly associated with incidence of popliteal artery injury during total knee arthroplasty—most notably, peripheral vascular disease increased the relative risk by nearly two. The rate of popliteal artery injury from the NIS data base was lower than that previously published in case series. This rate is not decreasing over time. To minimize risk of popliteal artery injury during total knee arthroplasty, surgeons should consider the specifics of each patient. In cases of revision surgery or peripheral vascular disease, preoperative vascular studies may be considered. In the presence of multiple comorbidities, surgeons should exert extra vigilance. All patients having TKA should be carefully monitored for the possibility of vascular injury.

Visiting Lectureships, Past and Present

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 Department of Orthopaedics & Rehabilitation at Oregon Health & Science University, 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, revered 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 (the precursor to OHSU) in 1956. He completed his internship at Minneapolis General Hospital followed by a General Surgical Residency in San Bernardino County Hospital in California. He ultimately completed his training in orthopaedic surgery at the University of Oregon Medical School (now OHSU) 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 chair 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 2012

Marc Swionkowski, MD

Orthopaedic Traumatologist

University of Minnesota



Visiting Professor, May 2013

Vernon Tolo, MD

Chief Emeritus, Children's Orthopaedic Center

Keck School of Medicine, USC

Visiting Lectureships, Past and Present

OHSU Orthopaedic Spine Professorship

Alan Hilibrand, MD, is professor of orthopaedic surgery as well as director of medical education for the Department of Orthopaedic Surgery at the Rothman Institute and Jefferson Medical College in Philadelphia. He specializes in the treatment of adult spinal disorders.

Dr. Hilibrand has authored or co-authored 130 articles in peer-reviewed journals, including *The New England Journal of Medicine* and *The Journal of the American Medical Association*. He currently serves as a deputy editor for *The Journal of the American Academy of Orthopaedic Surgeons* and *The Journal of Bone and Joint Surgery (Am)*.

He was recognized with the Jefferson Medical College AOA Clinical Faculty Teaching Award in 2001 and the Dean's Citation for Significant Contributions to the Advancement of Education in 2004. In the spring of 2007, he represented the American Orthopaedic Association as an ABC Travelling Fellow. Dr. Hilibrand also recently served as vice-chair to the AAOS Communications Cabinet.

Dr. Hilibrand earned his undergraduate degree from the Massachusetts Institute of Technology and his medical degree from Yale University School of Medicine in New Haven, CT. He completed his orthopaedic training at the University of Michigan Hospitals in Ann Arbor and a fellowship in spine and spinal cord injury at Case Western Reserve University in Cleveland.



2012 Visiting Professor, October 2012

Alan Hilibrand, MD

Thomas Jefferson University

Visiting Lectureships, Past and Present

Updates by Alan S. Hillibrand, MD

ADJACENT SEGMENT DISEASE OF THE CERVICAL SPINE

Anterior cervical spine surgery has been an effective way to treat patients with cervical radiculopathy and myelopathy for more than 50 years. However, the consequences of such surgery have been increasingly in the focus of orthopaedic spine surgeons as these patients come back for long-term follow-up. Specifically, two concerns have been discussed in the literature: adjacent segment degeneration, which refers to radiographic changes that occur adjacent to a previous cervical spine fusion and may not have any associated symptoms, and adjacent segment disease, which refers to the development of new clinical symptoms of radiculopathy and/or myelopathy which correlate with degenerative changes seen on radiographs at adjacent levels.

There is considerable controversy in the orthopaedic spinal literature as to whether adjacent segment disease is the result of the natural history of the patient's underlying cervical spondylosis or the biomechanical consequence of their cervical spine fusion. It is the thought that this may be caused by the spinal fusion itself that has led to the growth of a billion-dollar industry focused on motion preservation both in the cervical and lumbar spine. However, the scientific literature remains conflicted as to whether these changes are caused by the fusion or by the patient's underlying disease. Even the prospective, randomized trials of the cervical arthroplasty devices have not demonstrated a lower incidence of adjacent segment disease among patients undergoing arthroplasty as opposed to fusion at five years of follow-up. In addition, there are some concerns as to the potential for bias in these industry-funded studies. As a result, the conclusion may be reached that it still has yet to be determined whether adjacent segment disease of the cervical spine is patient disease or fusion disease.

AN UPDATE ON SPORT AND COMPARATIVE EFFECTIVENESS RESEARCH

The Spine Patient Outcomes Research Trial (SPORT) was the largest orthopaedic prospective randomized trial funded by the NIH. This study was designed to address concerns among some in the medical community regarding the appropriateness and effectiveness of lumbar spinal surgery. Spine surgeons from 11 medical centers around the country collaborated on this study which involved a total of over 2,000 patients. It included three arms; patients were prospectively randomized to surgical or non-surgical treatment for diagnoses of lumbar disc herniation, lumbar spinal stenosis and spinal stenosis with degenerative spondylolisthesis. The outcomes data have now been collected for a minimum of seven years, and 10-year outcomes data will be published over the next five years.

The most relevant findings of the study were that, in an "as treated" analysis, surgical treatment was demonstrably superior to non-operative treatment for all three diagnoses and for almost all subgroups within those diagnoses. In addition, this study has demonstrated that lumbar discectomy is very cost-effective as treatment for lumbar disc herniation. Cost-effectiveness studies have demonstrated that as these patients are followed over time, even more extensive treatments such as lumbar laminectomy and instrumented fusion for degenerative spondylolisthesis and spinal stenosis are also turning out to be cost-effective.

In the longer term, the 10-year follow-up data and cost effectiveness data should provide further evidence of the appropriateness of lumbar spinal surgery for patients with these conditions who have failed initial attempts at non-operative treatment.

Visiting Lectureships, Past and Present

Shriners Hospital for Children – Portland Lectureship Series

BEATTIE LECTURESHIP

Byron Beattie was the owner and operator of a printing plant in Portland, OR. 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 our local education activities. The first seminar was held in 1985.



Guest Lecturer 2012
James W. Roach, MD

James W. Roach, MD, is a professor of orthopaedic surgery at the University of Pittsburgh and the William F. and Jean W. Donaldson Endowed Chair in Pediatric Orthopaedics, as well as the medical director for Shriners Hospital for Children in Erie, PA.

Dr. Roach has a special interest in the treatment of complex spinal deformities, developmental dysplasia of the hip, and outcomes research. He is the director of the Unniversity of Pittsburgh Pediatric Orthopaedic Fellowship and a past president of the Pediatric Orthopaedic Society of North America.

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 and served as the first chief surgeon. His legacy continues through the Dillehunt Memorial Trust Fund, sponsoring visiting distinguished pediatric orthopaedic surgeons from around the world.



Guest Lecturer 2012
James Hui Hoi Po, MD

Associate Professor James Hui completed his medical degree at the National University of Singapore (NUS). He subsequently completed his surgical and orthopaedic training at the National University Hospital, Singapore. He is a fellowship-trained pediatric orthopaedic surgeon, having spent a year in Australia on a pediatric orthopaedic fellowship.

Dr. Hui is actively involved in undergraduate and post-graduate teaching at NUS. He is a member of numerous professional societies including the Pediatric Orthopaedic Society of North America, the Asia Pacific Orthopaedic Association and the Singapore Medical Association. Dr. Hui is actively involved in clinical and basic science research.

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
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 Matthew Harrison	Jayme Hiratzka Matthew Harrison
2012	Jesse A. McCarron	Luke Rust	Dawson Brown Matthew McElvany

Recent Graduates Orthopaedic Update: Class of 2010

Where are They Now?

An Update by Adam Cabalo, MD

Following residency, I went off to Daly City, CA, to do my spine fellowship with the Spine Care Medical Group. It was a great experience, and the attendings were awesome. I did a lot of surgery and learned a lot from them. Following that I set my sights on getting back to Hawaii to practice. The big decision was whether to pursue a private practice group or an HMO like Kaiser. I had a few good offers to do spine on Oahu, but in addition to getting back to Hawaii, I really wanted to get back home to Maui. So, fortunately a position at Kaiser on Maui opened up, and I jumped at the chance. The only caveat, though, was that it was for a general orthopedic position with no spine. This was the first time throughout medical school and residency that I realized I was making a real life decision and had to factor in more than just my goals.

I found out that practicing orthopedics on Maui is a rather unique situation in many respects. There are no orthopedic groups on Maui. All the private practice orthopedists are solo. There are currently two private practice orthopedists, one orthopedist employed by the one hospital on Maui and three orthopedists at Kaiser. I decided to join Kaiser because the position was on Maui, and it was a secure job. I have a wife and two kids to provide for, and having to start up my own practice just seemed too risky.

Because Kaiser doesn't have their own hospital, we have privileges at the only hospital on Maui. The ramifications of that is we take call for the entire island four days a month in addition to the Kaiser call. Since there are only three of us at Kaiser, I take call every third week for a whole week. Look closely at how often and how busy call is going to be in your practice. That's one big thing that I wish I had a lot less of – or even none.

Now, I know you must be thinking, "Call on Maui, how hard could that be?" You'd be surprised how many people get hurt on the island, especially

Fishing in Maui



the tourist population who come and do various outdoor activities. It was always my goal to see an open spine fracture and a true peri-lunate dislocation. Well, in my first few months here, I saw both. In addition to that, I've had a couple traumatic amputations, bad peri-articular fractures, along with countless hip and other peri-prosthetic fractures. Now during residency, I think most of us have the idea that we do all the different rotations in subspecialties of orthopedics with the idea that we're going to select one to focus on and then pursue a fellowship. And that's with the presumption that you're going to be doing a majority of cases in practice in whatever your fellowship training was in. I'm sure in some situations that becomes a reality.

Until you reach that point where you are out of residency and fellowship and you definitely know what your practice is going to be like, my best advice for the people still in residency: Learn everything you possibly can from all subspecialties. Never have the thought, "Oh, I'm going to specialize in something else, so I don't really have to learn how to do this case." I find myself trying to summon all the attendings at OHSU and remembering all the

(continued)

little tricks I was taught. In some respects, practicing general orthopedics is quite difficult because you never know what you're going to get, and you have to be able to take care of it.

A majority of my practice is doing knee and shoulder arthroscopies. Who would've thought?! I do a couple joints a month, as well as trigger fingers, carpal tunnel releases and then an assortment of fractures from call. Another thing you have to get used to out of residency is a lot of clinic. Four days out of the week I'm in clinic, and one day in the OR. I think the private orthopedists also have a similar schedule. For the most part, I'm pretty happy working for Kaiser; the main drawback with this position is the call. There's just too much and without residents or PAs, you are on your own with floor work and call.

But of course, if you're on Maui, you can't just work. You have to enjoy it. So, if I'm not working, then I'm either with the kids or on the water. Most recently I've been into kayak fishing. We head out 5 to 10 miles in the ocean looking for big fish. If you ever visit, I'll take you for an adventure. No guarantees you'll come back though.

A hui hou.

Recent Graduates Orthopaedic Update: Class of 2010

Where are They Now?

An Update by Gary Kegel, MD

After residency, I moved on to a hand/upper extremity fellowship program mostly based out of New York at the St. Luke's/Roosevelt/CV Starr hand surgery program. I spent a total of 12 months in New York training with Drs. Barron, Catalano and Glickel, which was a great experience. It was a great program and provided a wonderful education. As part of the program, I also spent three months in Dallas, TX, at the Scottish Rite Hospital doing pediatric hand surgery with Drs. Ezaki and Oishi. Additionally, my fellowship provided three months of elective time of which I spent more than two months in Jerusalem, Israel, working closely with four hand surgeons in their hand surgery unit at Hadassah Hospital and two weeks as an observer in Edinburgh, Scotland, at the Royal Infirmary with Dr. Margaret McQueen. Fellowship was a great experience, and for those of you still in training, I would highly recommend doing some kind of fellowship training as it is a great time to really advance your skills and knowledge in a specialized area.

I have now moved back to Seattle, WA where I am working at Group Health Cooperative, which is very similar to the Kaiser model that many of you are familiar with. Approximately 95 percent of my practice is dedicated to hand surgery, with the remaining 5 percent being general orthopedic cases that I pick up when I'm on call, which is typically about once per week with a weekend call every 5 to 6 weeks on average.

I have almost completed one year in practice, and the biggest challenges I have faced have been the critical decision-making on knowing when to move forward with surgery and when to continue non-operative treatment. The other challenge has been figuring out how to manage the long-term aspects of care such as progressing with a patient from their surgery through their post-op course until they are back to their usual activities as we do not gain that continued follow-up exposure during residency. Overall, life as a new attending is not necessarily any easier than being in residency, but it sure is more rewarding and enjoyable.



Fellowship graduation dinner

Recent Graduates Orthopaedic Update: Class of 2010

Where are They Now?

An Update by Gregory Byrd, MD

After completing my residency at OHSU, I traveled to Boston to complete a hand fellowship at Beth Israel Deaconess Medical Center. I selected this fellowship because it was a hybrid of orthopedics and plastics, which I truly enjoyed. I also was careful and only selected a fellowship with at least two fellows, which I would recommend to all residents looking at fellowships. Having another fellow to bounce ideas off of and share call was very beneficial.

After completing my fellowship, I wanted to get back to the Northwest and accepted a job in Olympia, WA, with Olympia Orthopaedic Associates. There are 12 orthopedic surgeons, two neurosurgeons and two physiatrists. We take general call at two hospitals that are both Level III; however, since we treat a population of around 500,000, this ends up resembling more Level II call. I tried to glean as much as I could from my residency and fellowship not knowing the exact type of practice I was entering.

I take care of pediatric fractures, hip fractures, ankle fractures and some bad peri-articular fractures while on call. I am very grateful for the experience and mentors that I had during residency, and still call occasionally with questions or for advice. As anyone will tell you, the first couple of months out on your own is a very stressful but exciting time. Enjoy.



Byrd family on vacation in Hawaii

Recent Graduates Orthopaedic Update: Class of 2010

Where are They Now?

An Update by Patrick Denard, MD

After residency, I completed an arthroscopic shoulder fellowship with Steve Burkhardt in San Antonio, TX, followed by a mini-fellowship in shoulder with Gilles Walch in Lyon, France.

I then joined Southern Oregon Orthopedics in Medford, OR, a private practice of 12 orthopedists that are all fellowship-trained. My elective practice is 100 percent shoulder. My partners have similar practices in their specialties. Although it is community practice, we cover a fairly large geographic area which results in range of case complexity, from simple cuff repairs to revision arthroplasty. I continue to do research and have a couple of prospective studies going on right now. We take call three to four days a month at two Level III hospitals caring for mostly osteoporotic fractures.

I chose OHSU for residency because of the combination of academics and hands-on experience. A little over a year into practice, I am thankful for the experience that allowed me to hit the ground running.

The Denard family at home in Jacksonville, OR



OHSU Orthopaedic Program Alumni Directory

YEAR	FELLOWSHIP*
2012	
Dawson Brown	Sports Medicine, Southern California Orthopaedic Institute
Peter Fredericks	OrthoIndy Trauma Fellowship
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
Jayme Hiratzka	Spine Surgery - University of Utah
Jackson Jones	Total Joint Arthroplasty - Brigham and Women's Hospital
2010	
Adam Cabalo	Spine Surgery - Spine Care Medical Group, Daly City, CA
Patrick Denard	Shoulder Arthroscopy - San Antonio, TX & 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	
2009	
Abner Ward	Hand Fellowship - Stony Brook Medical Center
Stephan Pro	Santa Monica Orthopaedic and Sports Medicine Group
Khalid Shirzad	Duke University Medical Center - Foot and Ankle Fellowship
2008	
Kate Deisseroth	
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
2006	
Catherine Humphrey	Orthopaedic Trauma - Vanderbilt University Medical Center, Nashville, TN
Amer Mirza	Trauma - Harborview Medical Center, Seattle, WA
Mark Wagner	

OHSU Orthopaedic Program Alumni Directory

YEAR	FELLOWSHIP*
2005	
Patrick Dawson	Upper Extremity and Sports Medicine - Congress Medical Associates, Pasadena, CA
Suresh Kasaraneni	
Chris Untch	
Corey Vande Zandschulp	Trauma - OrthoIndy, Methodist Hospital, Indianapolis, IN
2004	
Ben Kam	
Britton Polzin (Frome)	UT Southwestern Hand Surgery - Dallas, TX
2003	
Jennifer Miller	Sports Medicine - Congress Medical Associates, Pasadena, CA
Jeb Reid	
Eric Shepherd	Orthopaedic Trauma - UC Davis Medical Center, Davis, 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
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	
1998	
Dory Curtis	
Darrin Eakins	Sports Medicine - Royal N Shore Hospital, Sydney, Australia
Ron Wobig	

OHSU Orthopaedic Program Alumni Directory

YEAR	FELLOWSHIP*
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 Padra	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	
1991	
Ronald Bowman	
William Dickinson	
Richard Rubinstein	Methodist Sports Medicine Center, Indianapolis IN

OHSU Orthopaedic Program Alumni Directory

YEAR	FELLOWSHIP*
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
Robert Zirschky	
1988	
John DiPaola	
Jeffrey Flemming	University of Texas
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	
1983	
Michael Grundy	
Paul Mills	
John Schwartz	

OHSU Orthopaedic Program Alumni Directory

YEAR	FELLOWSHIP*
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	

YEAR	
1974	
Thomas Hutchinson	
Robert Porter, Jr.	
Fred Surbaugh	

YEAR	
1971	
Charles Bird	
Robert Chuinard	
Jim Dineen	
Ilmar Soot	

1977	
David Noall	
K. Byron Skubi	
Ted Vigeland	

YEAR	
1973	
James Baldwin	
David Haaland	
Craig MacCloskey	

YEAR	
1970	
Art Hauge	
Edwin Kayser	
Gerald Lisac	
Ira Yount	

YEAR	
1976	
W. Curtis Kaesche	
Walter Smith	
Stephen Thomas	

YEAR	
1972	
Michael Hmura	
Grant Lawson	
Michael Marble	

YEAR	
1969	
Thomas Fagan	
Michael Graham	
George Ingham	
Scott Struckman	

YEAR	
1975	
John Hayhurst	
Kelsey Peterson, Jr.	
Ned Schroeder	

OHSU Orthopaedic Program Alumni Directory

YEAR
1968
James Kunzman
James Nelson
Frederick Wade

YEAR
1960
Charles Fagan
Calvin Kiest, Jr.
Bud Yost

YEAR
1948
Robert Anderson
George Cottrell
Carl Holm
Ralph Thompson

1967
Michael Baskin
John Gilsdorf
John Thompson

1959
Raymond Case

1947
Edward LeBold

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

1958
Richard Gardner

1946
Donald Platner

1965
Arthur Eckhardt
John Hazel
Richard Mercer

1956
William Hummel
Jack Watkins

1942
Rodney Begg

1964
Robert Corrigan
Richard Zimmerman

1955
Edward Attix

1940
L.S. Porter

1963
Donn McIntosh
Michael Rask

1954
Howard Popnoe

1938
Arthur Compton

1962
Phaen Gambee
Norman Logan
Keith Taylor

1953
Donald Smith

1935
E.G. Chuinard

1961
Rodney Beals
Thomas Edwards
George Keyes
Ralph Peterson

1951
Phillip Fagan

1928
C. Leslie Mitchell

1949
Howard Cherry

1925
John LeCocq

1924
Leo S. Lucas

Special Thanks and Comments

We would like to give a special thanks to our Education Manager, Pamela Feidelson, for all that she does for our department. She continuously keeps the department organized and has been a tremendous help with the creation of this journal.

The goal of this publication is to grow and mature over the next several years. We would love any 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.

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