UT Health
San Antonio
Orthopaedics

The San Antonio Orthopaedic Journal

2025 - VOLUME VIII

EDITORS

Christina Brady, MD | Shelby Briscoe, MSA | Benjamin Fitch
Kathleen F. Lundquist, MD | Blaire Peterson | Boris A. Zelle, MD, MBA

Photo by Boris A. Zelle, MD, MBA

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1. H John Cooper, Ronald P Silverman, Ashley Collinsworth, Christine Bongards and Leah Griffin. 2023. "Closed Incision Negative Pressure Therapy vs Standard of Care Over Closed Knee and Hip Arthroplasty Surgical Incisions in the Reduction of Surgical Site Complications: A Systematic Review and Meta-analysis of Comparative Studies." Arthroplasty Today 21, 101120. https://doi.org/10.1016/j.artd.2023.101120.

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CONTENTS

Preface: Reflections and Transitions

Christina Brady, MD and Boris A. Zelle, MD, MBA

We feel honored and privileged to present the 2025 *San Antonio Orthopaedic Journal* (SAOJ). Above all, we would like to congratulate the graduating class of 2025, Annat Houston, Stephanie Jones, Ezekial "Zeke" Koslosky, Kathleen Lundquist, Samuel Ornell, and Loc-Uyen Vo. We are very proud of this talented group, with all graduating residents pursuing top-notch fellowships in arthroplasty, foot and ankle, trauma, and spine. We are looking forward to seeing your careers thrive.

As we are presenting this year's edition, we would also like to share with our readers that this will be the last edition that we will serve as editors-in-chief. It has been since 2018 that we have had the honor to serve as the editors of this publication. Over the years, we have continued to elevate the length and quality of this publication, and we hand over the journal with a profound sense of gratitude.

While the SAOJ has seen substantial growth over the years, the aim of the journal has never changed. Thus, it has continued to be our goal to highlight the department's clinical operation, educational mission, research accolades, and above all honor our graduating orthopaedic chief residents. As there will be transition for this publication, we remain confident that the core and the mission of the SAOJ will stay the same. We are looking forward to seeing this publication thriving as one of the highest-quality orthopaedic department journals in the nation.

Finally, we would like to extend our gratitude to all individuals who have supported this publication over the years. This includes the numerous contributing faculty, alumni, fellows, residents, and students, as well as the great administrative support staff, industry sponsors, media and print services. Your contributions have been the cornerstone of our shared success.

Sincerely,

Boris Zelle and Christina Brady
Editors-in-Chief

Resident Editor

Kathleen F. Lundquist, MD, Resident Editor

It is an incredible honor to serve as the Resident Editor of the eighth edition of the *San Antonio Orthopaedic Journal.*

This has been a year marked by growth and expansion. Most notably, the UT Health San Antonio Multispecialty and Research Hospital (MSRH) is now open. Orthopaedics promises to be a prominent player at the new hospital having already completed numerous spine and joints cases at the state-of-the-art facility. Please read the full update on the new facility by Drs. Caput and Buttacavoli who have been instrumental in its opening. Furthermore, the new clinical building and surgery center at Kyle Seale Parkway (KSP) is up and running.

At a resident level, we have also had a great year under the leadership of our Program Director, Assistant Program Director, and Administrative Chief, Drs. Rose, Gibbons, and Vo, respectively. We thank them for all their hard work and dedication to the program over the past year. The residents were very involved in research, presented at many national conferences and even made the cover of *JAAOS*. As a program, we also scored in the 61st percentile nationally on the OITE, all while squeezing in a little time for fellowship, fun, and a time with co-residents and families. Please see the "Ortho Illustrated" section for some great photos from this past year!

This year's graduating class includes Annat Houston, MD, Stephanie Jones, MD, Ezekial Koslosky, MD, Kathleen Lundquist, MD, Samuel Ornell, MD, and Loc-Uyen Vo, MD. All six graduates will be attending distinguished one-year fellowships in arthroplasty, foot and ankle, trauma, and spine. You can read more about each graduating resident in the Residency Updates, Class of 2025 section. I am proud to be graduating with this amazing group of individuals and surgeons.

This past year has been wonderful for the Department of Orthopaedics, and I look forward to seeing the continued progress in the coming years. I hope you enjoy this edition of the *San Antonio Orthopaedic Journal.*

Medical Student Editorial

Blaire Peterson, MS3 and Benjamin Fitch, MS2

As the medical student editors, it is our pleasure and honor to have this wonderful opportunity to work alongside the team creating this journal. As students, we are in a unique position where our job from 9–5 is to learn. We are fortunate to be surrounded by mentors who challenge us to expand our knowledge beyond textbooks and lectures, pushing us to engage with the evolving landscape of orthopaedics through hands-on clinical experiences and academic inquiry. Along with our colleagues, we are looking forward to becoming the next generation of surgeons providing the future of musculoskeletal care.

Our journey to becoming orthopaedic surgeons extends beyond the classroom. It unfolds in the operating room, where we witness the precision and skill of our mentors, in the clinic, where we learn the art of patient care, and in the trauma bay, where we see the acute impact of our field firsthand. These experiences fuel our passion for discovery and inspire us to engage in research that deepens our understanding of orthopaedic principles and advances the field.

This journal stands as a testament not only to the rigorous academic work taking place at UT Health San Antonio but also to the invaluable mentorship that fosters growth at every stage of training. This dedication is reflected in this issue, particularly in our section highlighting conferences attended by our medical student and resident colleagues alongside our faculty mentors. These conferences provide invaluable opportunities to present research, exchange ideas, and strengthen our professional community.

We are grateful to everyone who contributed to this journal—authors, mentors, faculty, and fellow students—whose dedication makes this publication possible. We hope that within these pages you find inspiration, knowledge, and a shared passion for the field of orthopaedic surgery.

Chairman's Corner

Robert H. Quinn, MD, FAAOS, FAOA, Chair, Department of Orthopaedics

I am pleased to introduce the eighth edition of the *Orthopaedic Journal* of UT Health San Antonio, marking our department's 57th anniversary. I am very proud of the superb faculty we have on our team and their strong dedication to our combined missions of clinical excellence, research, and education. After many years of hard work, our future has now arrived.

The biggest news at an institutional level is the pending merger of UTSA with UT Health San Antonio, creating the third-largest university in Texas. This merger will position us in the top tier of universities nationally and promises a bright future for all of us and the patients and students we serve.

The UT Health San Antonio Multispecialty and Research Hospital (MSRH) has opened its doors and clinical activity is expected to rapidly expand through the spring and summer of 2025. MSRH is a state-of-the-art cancer/specialty hospital with a significant orthopaedic footprint. The single biggest impediment to growth at UT Health since its founding has been a lack of a large revenue source with which we can invest in our future. The practice plan has done exceedingly well but simply does not create the type of margin necessary to advance our missions of patient care, education, and research into the top tier of academic medical centers. This hospital represents a great step forward in the evolution of our academic medical center. Orthopaedics will play a prominent role in the success of this hospital.

Our new medical office building at Kyle Seale Parkway is up and running, including a new ambulatory surgical center, is now open for business. This building will represent a major hub for our outpatient musculoskeletal service line activities with a heavy emphasis on sports medicine.

Plans are in the works for other new medical office buildings located in various strategic areas around the city.

Our partnership with the San Antonio Spurs continues to grow and evolve. Guy Nicolette, MD, remains the overall team physician. Leah Brown, MD, has now joined us as the team orthopaedic surgeon and a new sports surgeon academic partner. This is a true partnership and not simply a transactional one. Beyond providing medical coverage for the team, we are also partnering to build a world-class Human Performance Institute. Joe Alderete, MD, is the inaugural director. A dedicated new building will be constructed on the location of the Spurs new practice facility with estimated completion in 2026/2027. The building will contain a large laboratory space, a large physical therapy center, and clinic space, including imaging.

Our multi-disciplinary spine center has continued to mature under the direction of Chris Chaput, MD. This center is a partnership between orthopaedics, neurosurgery, and PM&R with an EOS imaging machine and has already seen early success.

We anticipate a substantial and progressive growth in elective orthopaedic procedures in preparation for the new hospital, particularly in the areas of adult reconstruction and spine, and we will be working aggressively to expand our clinical volume and faculty recruitment in these areas.

We are seeing rapid growth and increasing demand in all of our specialty areas and will continue to recruit and grow aggressively to meet this demand and continue to enhance our core missions of education and research. This includes podiatry which is rapidly expanding under the leadership of Lee Rogers, DPM, who is well on his way to achieve his vision to reestablish our program as the international leader in the management of diabetic foot challenges.

I remain proud, and humbled, to lead such a great group of faculty, residents, researchers, and staff. These are exciting times in San Antonio and I look forward to watching our great program grow and mature.

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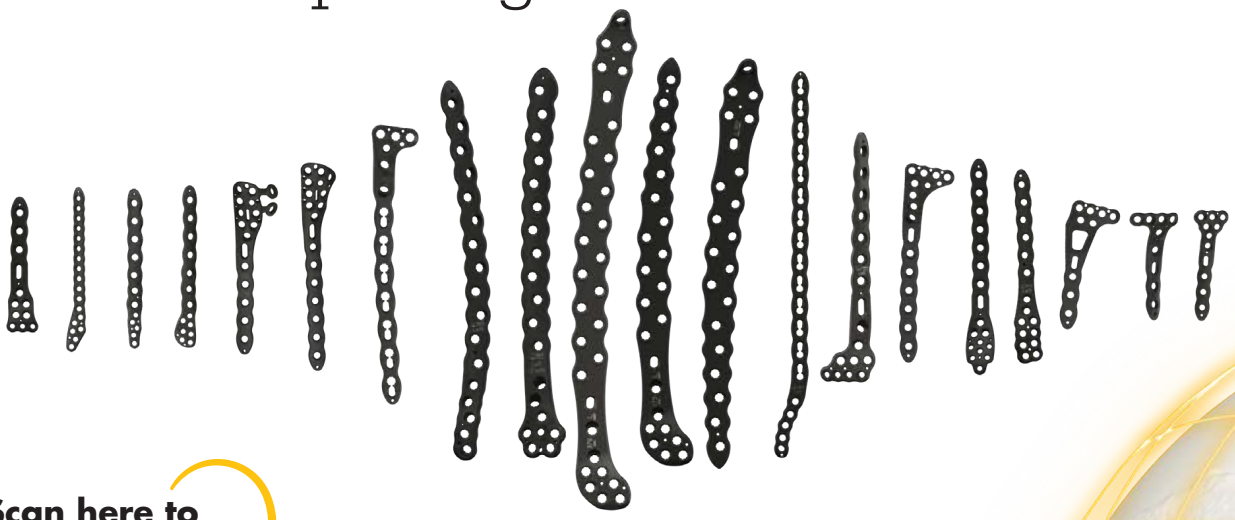

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01

Special Announcements

Staff Highlights

Shelby Briscoe, CPA, MSA
UT Health San Antonio

Shelby Briscoe, CPA, MSA is the Administrator and Director of Finance for the Department of Orthopaedics at UT Health San Antonio. Since joining the department in May 2023, she has played a pivotal role in financial strategy, operational efficiency, and faculty growth. Under the leadership of Chairman, Dr. Quinn, and through her strategic partnership, the department has expanded significantly, adding new faculty, securing key contracts—including serving as the official provider for the San Antonio Spurs—and opening multiple new clinical sites.

Prior to this role, Shelby served as the Senior Director of Finance for the Department of Obstetrics and Gynecology at Texas Tech University Health Sciences Center, where she provided leadership and administrative oversight across clinical activities, finance, HR, IT, academic programs, and grants. She also held leadership roles in Accounting Services at Texas Tech University, where she compiled the institution's Annual Financial Reports.

Shelby is a Certified Public Accountant (CPA) and holds a Master of Science in Accounting from Texas Tech University. Now based in San Antonio, she is committed to advancing the mission and growth of Orthopaedics through strategic financial and administrative leadership.

Lashun Matthews, C-TAGME
UT Health San Antonio

Lashun Matthews, C-TAGME is the Graduate Medical Education (GME) Program Manager for the Department of Orthopaedics at UT Health San Antonio. With over a decade of experience in academic program management, she plays a vital role in overseeing the education and training of 35 orthopaedic surgery residents, 9 podiatry residents, and 4 fellowship programs. She ensures compliance with ACGME and CPME accreditation standards while continuously enhancing the department's educational mission.

Lashun joined the Department of Orthopaedics in 2012 and, through her dedication and leadership, steadily advanced into key academic roles. She served as an Academic Programs Coordinator before becoming GME Manager in 2022. Her expertise has been instrumental in the department's growth, including the upcoming launch of five new fellowship programs at the Multispecialty and Research Hospital (MSRH).

A Certified Training Administrator in Graduate Medical Education (C-TAGME), Lashun is widely recognized for her leadership and professional excellence. Her accomplishments include receiving the GME Very Important Professional Award (2024), earning a scholarship from the Association of Residency Coordinators in Orthopaedic Surgery (2022), and being selected as a prospective member of the ARCOS Board of Directors.

Committed to ongoing professional development, Lashun recently completed the 2024 Accelerated Management Program with high reviews. Her passion for graduate medical education, leadership in program development, and dedication to excellence make her an invaluable asset to the Department of Orthopaedics.

New Faculty

Ian Barron, DPM, FACFAS
Assistant Professor
UT Health San Antonio

Ian Barron, PDM, FACFAS completed his residency training at The Ohio State University, where he developed a strong foundation in foot and ankle surgery. As a Fellow of the American College of Foot and Ankle Surgeons and a Diplomate of the American Board of Foot and Ankle Surgery, he is board-certified in Foot and Reconstructive Rearfoot and Ankle Surgery. Dr. Barron specializes in a wide range of procedures, including minimally invasive techniques, arthroscopic surgery, ligament and tendon repair, complex limb salvage, and fracture repair. His clinical interests lie in advancing surgical techniques and providing cutting-edge, compassionate care to help patients regain mobility and improve their quality of life.

Dr. Barron's passion for education and research has been a driving force throughout his career. As the Associate Program Director of the Podiatric Medicine and Surgery Residency at UT Health San Antonio, he is dedicated to shaping the next generation of podiatric surgeons. He values the opportunity to be involved in resident education within a university setting, helping foster a culture of learning and innovation. Dr. Barron also plans to continue publishing, speaking at con-

ferences, and advancing his career while contributing to academic and clinical excellence.

What attracted Dr. Barron to join the Department of Orthopaedic Surgery at UT Health San Antonio was the department's strong commitment to clinical excellence, collaboration, and academic advancement. He looks forward to contributing to the team's mission and continuing to build a robust educational program.

Dr. Barron resides in Boerne with his wife Kim, who is also a podiatrist in the department, and their two children, Everett and Avery. Outside of work, he enjoys spending time with his family, grilling, playing golf, and exploring the outdoors.

Kimberly Barron, DPM
Assistant Professor
UT Health San Antonio

Kimberly Barron is a highly skilled and compassionate advocate for foot and ankle health, bringing a wealth of expertise and personalized care to every patient she treats. A proud Texan, she earned her undergraduate degree from Baylor University before attending Kent State College of Podiatric Medicine for her medical training. Dr. Barron completed her surgical residency at The Ohio State University, where she refined her skills and embraced cutting-edge advancements in podiatric surgery.

As a Fellow of the American College of Foot and Ankle Surgeons and a Diplomate of the American Board of Foot and Ankle Surgery, Dr. Barron is board-certified in Foot Surgery, underscoring her commitment to excellence in the field. She offers a comprehensive range of surgical treatments, including bunion and hammertoe correction, ligament and tendon repair, sports medicine, arthroscopy, diabetic wound care, and fracture repair. With a focus on patient-centered care, Dr. Barron ensures that each individual fully understands their condition and treatment options, empowering them to make informed decisions that align with their unique needs and lifestyles.

Dr. Barron's practice is built on a foundation of patient education, evidence-based research, and a passion for improving the lives of those she treats. Outside of her practice, she enjoys spending quality time outdoors with her husband, Ian Barron, who is also a podiatrist at UT Health San Antonio, and their two young children—a son, 2.5 years old, and a daughter, 1 year old. As a lifelong runner, Dr. Barron deeply understands the importance of maintaining healthy feet, both professionally and personally.

Leah Brown, MD
Associate Professor
UT Health San Antonio

Leah Brown, MD, is a board-certified, fellowship trained orthopaedic surgeon specializing in sports medicine and treatment of the knee, shoulder and elbow. She is an associate professor with the University of Texas Health Science Center at San Antonio and is the newly appointed head team orthopaedic surgeon for the NBA San Antonio Spurs. She was previously with the Banner Sports Medicine/University of Arizona College of Medicine and the head team orthopaedic surgeon for the WNBA Phoenix Mercury and assistant team orthopaedic surgeon for the NBA Phoenix Suns.

She received her Bachelor of Science in genetics from the University of Georgia where she was a 14-time NCAA All-American, a two-time NCAA National Gymnastics Champion and was inducted into the University of Georgia's prestigious Circle of Honor in 2016. After completing her undergraduate work, she earned a Doctor of Medicine degree at The Ohio State University and The Cleveland Clinic Foundation on a full US Navy Health Professionals Scholarship followed by a Surgery internship at the Naval Medical Center San Diego.

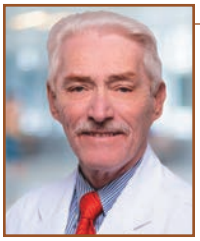
Dr. Brown served for two years as a Battalion Surgeon (General Medical Officer) at Marine Corps Base Camp Pendleton. In 2006, she deployed to Iraq in support of Operation Iraqi Freedom, where she served as the Medical Aid Station Director for Combat Logistics Battalion-5. Dr. Brown completed a four-year residency in the Department of Orthopaedic Surgery at Naval Medical Center San Diego and subsequently joined the Center's Department of Orthopaedic Surgery as a faculty orthopaedic surgeon. Her next assignment was as a faculty orthopaedic surgeon at Naval Hospital Bremerton in Bremerton, Washington. In 2012, Dr. Brown was deployed to Afghanistan as a part of Operation Enduring Freedom, where she served as Orthopaedic Surgery Department Head directly supporting the Combined Joint Special Operations Task Force led by SEAL Team 4. She is the recipient of many military honors and awards, including the Bronze Star, Meritorious Service Medal and Navy Commendation Medals. She continues her military service as a Captain (O-6) in the US Navy Reserves.

Dr. Brown is fellowship trained in sports medicine and shoulder and elbow, completing her fellowship at OrthoCarolina in Charlotte, North Carolina. During her fellowship, she was an assistant team physician for the 2016 NFC Champions, Carolina Panthers and athletic departments for University of North Carolina in Charlotte and Davidson College in Davidson, North Carolina. She is an NFL orthopaedic consultant and has served roles as Head Team Orthopaedic

Surgeon for the WNBA Phoenix Mercury, Assistant Team Orthopaedic Surgeon, NBA Phoenix Suns, and an official orthopaedic consultant for Arizona State University.

Dr. Brown is a Diplomate with the American Board of Orthopaedic Surgery, a Fellow with the American Academy of Orthopaedic Surgery, a Member of the American Orthopaedic Society for Sports Medicine and Arthroscopy Association of North America and is on the board of The Forum. She is also an official medical volunteer and consultant for the United States Olympic and Paralympic Committee. Dr. Brown has previously served as a Department of Surgery Chair, Quality Committee Chair and on multiple medical executive boards. She has faculty appointments with Arizona State University and the University of Arizona.

Dr. Brown was born and raised in Atlanta, Georgia. She is a dedicated advocate and mentor for students and young professionals. She is a University of Georgia Foundation Trustee, a founding member of Georgia Women Give, and serves on the UGA Athletic Association Board. She had the honor of delivering the 2023 UGA Spring Undergraduate Commencement Address. In her free time, she enjoys engaging in her philanthropic passions and cheering for the Georgia Bulldogs with her husband and twin children.



Robert G. Frykberg, DPM, MPH, FFPM (Glasgow)
Assistant Professor
UT Health San Antonio

Robert G. Frykberg, DPM, MPH, FFPM (Glasgow) is the Podiatry Residency Director and Professor/Clinical, Department of Orthopaedics at UT Health San Antonio. An Honorary Professor of Podiatric Medicine at University of Galway, he was also the former Chief of the Podiatry section and Residency Director at the Phoenix Veterans Affairs Medical Center in Phoenix, Arizona.

A former Chair of the Foot Care Council of the American Diabetes Association and Past President of the American College of Foot and Ankle Surgeons, Dr. Frykberg was the 2011 recipient of the prestigious Roger Pecoraro Award from the Foot Care Council of the American Diabetes Association.

He received his Master of Public Health degree from the Harvard School of Public Health in 1994 with a concentration in quantitative methods.

Dr. Frykberg's research and writing interests have included all facets of lower extremity disorders, but specifically focused on diabetic foot ulcers, infections, Charcot foot, Surgery, and Wound care. The author of over 100 peer reviewed publications and textbook chapters, he has also been the Editor of two textbooks: The High Risk Foot in Diabetes Mellitus (1991) and the Diabetic Charcot Foot (2010). Prof. Frykberg is currently a Director of the International Association of Diabetic Foot Surgeons, a Fellow of the Faculty of Podiatric Medicine of the Royal College of Physicians and Surgeons of Glasgow, and a Fellow, Royal Society of Medicine.

David Heath, MD
Assistant Professor
UT Health San Antonio

David Heath, MD, a former graduate of the UT Health San Antonio residency program, returns to the department as a Sports Medicine Surgeon and one of the Team Physicians for University of Texas at San Antonio (UTSA) Athletics. Originally from Corpus Christi, Texas, and raised in Round Rock, Texas, Dr. Heath's passion for sports and academics began early in his life. As a multi-sport athlete, he excelled in football, playing at the collegiate level for Furman University in Greenville, South Carolina. During his two seasons with the team, he earned Academic All-Southern Conference Honors and was consistently recognized on the Dean's List.

After transferring to Baylor University for family reasons, Dr. Heath completed his Bachelor of Science in Biology, graduating Magna Cum Laude. There, he received the Outstanding Senior in Biology Award, was named to the Dean's List each year, and was inducted into the Delta Epsilon Iota Academic Honor Society.

Following his undergraduate success, Dr. Heath pursued his medical degree at the Long School of Medicine in San Antonio, Texas. It was here that he developed a deep passion for orthopaedic surgery, publishing research and gaining early exposure to the field with the department. During medical school, he earned the Outstanding Student in Orthopaedic Surgery Award, the Superior Achievement Award for class leadership in gross anatomy, and was inducted into the Alpha Omega Alpha (AOA) Medical Honor Society.

Dr. Heath continued his training at UT Health San Antonio, where he completed his residency in orthopaedic surgery. His academic achievements during residency included multiple podium and poster presentations at national conferences, as well as earning the Roy Davis/Albert Sanders Resident Research Award two years in a row. He also received a best paper nomination from the Pediatric Orthopaedic Society of North America and had his work featured in the *American Academy of Orthopaedic Surgery*'s (AAOS) newsletter, AAOS Now.

After residency, Dr. Heath pursued advanced fellowship training in sports medicine and arthroscopic surgery at the renowned University of California, Los Angeles (UCLA) Department of Orthopaedic Surgery. There, he served as Assistant Team Physician for prestigious organizations such as the Los Angeles Lakers, Los Angeles Sparks, Red Bull, and UCLA Athletics. During this time, he received the Journal

of Bone and Joint Surgery Open Access Award for best published manuscript and continued to publish multiple other manuscripts.

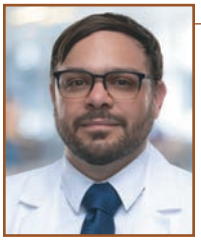
Whether on the sideline, in the clinic, or in the operating room, Dr. Heath is committed to providing modern, evidence-based, holistic care for his patients. He has a profound interest in knee ligament restoration, meniscal pathology, cartilage preservation and transplantation, shoulder instability, rotator cuff tears, hip arthroscopy, and all sports-related injuries. Outside of his professional endeavors, Dr. Heath enjoys spending time outdoors and cherishing new adventures with his wife, Sabrina, and their daughter, Madison.

Lawrence Lavery, DPM
Assistant Professor
UT Health San Antonio

Lawrence A. Lavery, DPM, MPH is a tenured professor in the Department of Orthopedic Surgery at the University of Texas Health Science Center in San Antonio, Texas. He was raised in Merrillville, Indiana with his twin brother David and sister Patricia. Dr. Lavery received a BS from Indiana University, Bloomington, Indiana and a DPM from Rosalind Franklin University of Medicine and Science, Dr. William Scholl College of Podiatric Medicine, Chicago, Illinois. He then completed a residency in Podiatric Medicine and Surgery from the University of Texas Health Science Center in San Antonio, Texas. He is board certified by the American Board of Podiatric Surgery.

Dr. Lavery's clinic and research interest is diabetic foot complications. He has a special interest in complex wounds, osteomyelitis, and innovative therapies. He is the Chair-Elect of the Foot Care Counsel for the American Diabetes Association. He is a founding member of the International Working Group on the Diabetic Foot and has served on the diabetic foot prevention and foot infection study groups. His research team has received extramural funding from the National Institute of Health, Veterans Administration, Agency for Healthcare Research and Quality, Department of Health and Human Services, American Diabetes Association, Department of Defense, and the American College of Foot and Ankle Surgeons. He has published over 400 peer reviewed papers and text chapters. His H index is 108. Experscape identified Dr. Lavery as the 4th leading expert in the world on the diabetic foot and the 8th leading expert on osteomyelitis.

Dr. Lavery has been married to his wife Karen for 40 years (that can't be right). They met the summer before their senior year at Indiana University and started dating in the Fall. Together, they have three sons, Ryan, Matthew, and Connor. Their household is ruled by two German Shorthair Points (Jack and Bella) that enjoy hunting upland game birds and unsuccessfully stalking squirrels and geckos in the backyard. They are in charge of home security and arranging and prioritizing sleeping positions for the family.



Arthur Tarricone, DPM, MPH
Assistant Professor
UT Health San Antonio

Arthur Tarricone is a Board-Certified podiatric surgeon specializing in diabetic limb salvage and research. He holds a master's degree in Biostatistics from the Icahn School of Medicine at Mount Sinai and a Doctor of Podiatric Medicine from the New York College of Podiatric Medicine. He completed his residency at SUNY Downstate Medical Center and fellowship in diabetic limb salvage and research at the University of Texas Southwestern Medical Center.

Dr. Tarricone is a licensed podiatrist in both Texas and New York. He has a passion for research, and this is reflected in his awards and publications. His research interests have led to collaboration across multiple specialties including translational research, interventional cardiology, vascular surgery, and orthopedic surgery. While his research efforts have been interdisciplinary the focus has remained consistent: preservation of the lower extremity and limb salvage. Dr. Tarricone has presented his research findings at prestigious national and international meetings including American Diabetes Association (ADA), American College of Foot and Ankle Surgeons (ACFAS), American Society of Podiatric Surgeons (ASPS), American Orthopedic Foot and Ankle Surgery (AOFAS), and the Diabetic Foot Study Group (DFSG). Additionally, he has published more than 45 peer-reviewed manuscripts. Dr. Tarricone has been the recipient of multiple manuscript awards and was awarded the early career faculty award from the Wound Healing Society.

Dr. Tarricone is excited to be a part of the podiatry team at University Health Science Center at San Antonio to further support limb salvage efforts and be a part of the podiatric surgical residency. In his spare time, he enjoys reading science fiction, playing chess, traveling with his wife and dog, and exploring this new area he now calls home.

Karla Tarricone, DPM
Assistant Professor
UT Health San Antonio

Karla Tarricone is a highly accomplished bilingual (English/Spanish) Board-Certified podiatric surgeon. She grad-

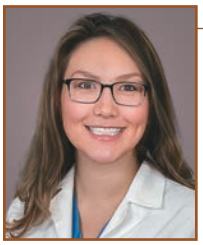
uated Magna Cum Laude with a Bachelor of Science in Biology from East Stroudsburg University. Dr. Tarricone then earned her Doctor of Podiatric Medicine degree from the New York College of Podiatric Medicine, where she made the Dean's List, was inducted into the Pi Delta Honor Society and received numerous scholarships. She is a member of various professional organizations including the American Board of Podiatric Medicine (ABPM) and the American Association of Women Podiatrists (AAWP). She has also been very involved with the American College of Foot and Ankle Surgeons (ACFAS); she has served on two committees contributing to promoting the profession and has been a moderator of podcasts and lectures at the annual scientific meetings.

Following medical school, Dr. Tarricone completed a rigorous Podiatric Medicine and Surgery Residency at Lenox Hill Hospital at Northwell Health. Her passion for learning and advancement in the field led her to pursue a Foot and Ankle Deformity Correction Fellowship at the prestigious Paley Orthopedic and Spine Institute in West Palm Beach, Florida.

Dr. Tarricone is enthusiastic to join the University of Texas Health Science Center to help children and adults regain mobility and improving their quality of life. Her background in dance and cheerleading has given her a unique perspective on foot and ankle health, and her fellowship training allows her to provide the most advanced care possible. She has a particular interest for elective surgery including the management of bunions, hammertoes, flat feet. She also treats foot and ankle trauma including Lisfranc injuries/dislocations and various fractures. When she is not in the office, Dr. Tarricone relishes spending time with her family, cuddling with her lovable Schnauzer, enjoys fashion and shopping, and trying out new restaurants.

Promotions

Steven D. Gibbons
Promoted to Associate Professor
as of September 1, 2024



Christina I. Brady, MD
Promoted to Associate Professor
as of September 1, 2025

Honors and Awards

Dr. Arthur Tarricone – 2024 Wound Healing Society Early Carrier Faculty Award

The Wound Healing Society (WHS) Early Carrier Faculty Award recognizes rising stars in wound healing research providing them with support and mentorship to further their impactful work. Dr. Arthur Tarricone, Assistant Professor of Orthopaedic Surgery at UT Health San Antonio was selected as the 2024 recipient of the award in recognition of his significant contributions to the field, particularly in diabetic limb salvage and his exceptional ability to foster multidisciplinary collaboration. His unique blend of podiatric expertise and biostatistical knowledge has helped fuel the Division's robust research enterprise. Dr. Tarricone's work is characterized by its collaborative nature, engaging experts across multiple specialties including translational research, interventional cardiology, vascular surgery, and orthopaedic surgery. His dedication to clinically relevant research, including work on critical limb ischemia and biomarkers for osteomyelitis, and his proven ability to bridge disciplines makes him a true leader in the field and a worthy recipient of the WHS Early Carrier Faculty Award.

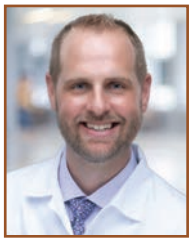
VA Outstanding Dedication to Patient Care Award

We would also like to recognize Dr. Ahmed "Sunny" Makhani (PGY-4) for his outstanding dedication to patient care. Dr. Makhani was recently presented with an award in recognition of his excellence in providing care above and beyond expectations for a veteran. The VA periodically issues this award to residents who demonstrate exceptional commitment to our veteran population, and we are proud to see our trainees embodying the mission of service. Congratulations to Dr. Makhani for this well-earned recognition!

02

Residency Updates

Residency Updates



Ryan Rose, MD, Program Director

The UT Health San Antonio Orthopaedic residency continues to grow year in and year out, mirroring the city of San Antonio while seeing the largest complement of residents in its history. As we approach the 2025 residency match, this culminates the resident expansion with 35 residents. The strong history of the department is, at its core, what makes the residency genuinely outstanding. With its growth has come another rotation for the PGY4s designed to mimic general Orthopaedics and the vast diversity of cases possible. The plan for next year's curriculum is to highlight the new Multispecialty and Research Hospital building and experience. Our future chiefs will oversee the operating rooms day in and day out, honing their skills in preparation for their fellowships. Dr. Steven Gibbons, APD, and I believe that residents must oversee the operating room and the healthcare system to become excellent orthopedic surgeons.

While the growth of the residency is impressive, it has paled in comparison to the development of the practice and our footprint across the city. Since 2023, we have added five faculty (Hand, Oncology, Peds, and two Sports), and in 2025, we will be adding two more arthroplasty surgeons and one additional sports, continuing the expansion. On top of the robust clinical faculty, their acquisitions have led to case volumes in the country's 90+ percentile range. While balancing the demand, the goal of the residency and UT Health San Antonio has remained the same: to provide excellent care for the patients of South Texas and beyond.

This year marks the completion of the transition to coverage of the San Antonio Spurs. Our Sports division has reached a critical volume of high-level sports coverage. The volume has led to the return of a previous resident, Dr. David Heath, the addition of Dr. Leah Brown, and 2025-2026, another alum of our residency, Dr. Adam McNulty. The sports experience is now becoming the most influential division in the program and residency.

The graduating class of 2024 all passed their ABOS Part 1 without difficulty. Four years ago, we identified the need for advance in the educational component of the residency. The residents have embraced this with full force. We nearly doubled our research contributions per year, and our OITE percentile for the entire residency was 61%. This percentile is the highest for our program for an extended time. This metric, coupled with operative volume, makes us one of the best in the state and across the country. This excellence is exemplified by the fellowships our chiefs matched into for the 2025-2026 year. These include arthroplasty at UPenn, foot and ankle at Emory, foot and ankle at UT Houston, trauma at HSS, trauma at Florida Orthopaedic Institute, and spine at Ortho Carolina. These fellowships will be proud to have our residents as their future alumni.

Our residents' pride in the residency has been acknowledged both locally with GME and nationally with the ACGME. This pride begins with the leadership of Ms. Lashun Matthews, Ms. Phylicia Hernandez, and our newest addition, Ms. Yahaira Ortiz. The administration staff is second to none; without them, we would be unable to grow and flourish.

As I am completing my 4th year as Program Director, it is astonishing to see the growth of the program and the department. I cannot begin to describe the pleasure I have to be part of both, and I can only eagerly await what the future holds. Thank you to the residents, faculty, education office, and everyone who made this residency great. Without you, the future of orthopaedics would suffer.

Class of 2025

Annat Houston, MD

Born in Israel to Russian immigrant parents, Annat grew up in Houston, Texas where she learned the values of hard work and passion from her family. She played as a competitive tennis player throughout her youth and went on to play for the University of Texas. While doing so, she became intrigued with musculoskeletal physiology and medicine. During her medical school training at UT Houston, she discovered a deep passion for orthopaedics and honorably landed a residency spot at UT Health SA. While in residency, Annat and her wonderful husband, Cliff, welcomed a baby boy named Levi into their family. Next year, Annat will return to Houston to complete a fellowship in Foot and Ankle. In her free time, Annat enjoys spending time with her family and 100-pound Bernedoodle named Kodiak.

Stephanie Jones, MD

Stephanie was born in Kingston, Jamaica. She immigrated to the United States at the age of 6 and was raised in Atlanta, Georgia. She attended St. Pius X Catholic High School where she was a student-athlete – receiving honors as a National Merit Scholarship Semifinalist and winning the 2010 Georgia State Women's Soccer Championship. Stephanie developed an interest in medicine while in high school – which she credits to the influence of her grandmother, an anatomy and biology teacher. Stephanie went on to receive a bachelor's degree in Psychology from Duke University. While at Duke, Stephanie worked as a student athletic trainer and was awarded a Varsity Letter for her commitment to the athletic program. Her role as a student athletic trainer established the foundation for her interest in musculoskeletal medicine. Stephanie then returned to Atlanta where she attended Morehouse School of Medicine. While at Morehouse, Stephanie forged her commitment to providing care to underserved communities and nurtured her desire to pursue a career in orthopaedic surgery. It was also during this time that Stephanie met her husband, Dr. Franklin Valdera. Stephanie matched at UT Health San Antonio, her #1 choice – due to the historical excellence, high-volume of orthopaedic pathology, and diverse patient population. During residency, Stephanie has cultivated an interest in foot and ankle pathology, particularly sports-related injuries and degenerative conditions. Next year, Stephanie will return home to Atlanta and complete a fellowship in foot and ankle surgery at Emory University. Stephanie is honored to be a graduate of UT Health San Antonio, and she is incredibly proud to be an orthopaedic surgeon. Stephanie (and Franklin) have enjoyed their time in San Antonio and have made wonderful life-long memories alongside their beloved dogs – Puggy (R.I.P) and Lina. She looks forward to what the future holds for her career and family.

Ezekial Koslosky, MD

Ezekial was raised in Dillon, Montana, where the values of hard work, curiosity, and community shaped his path. His parents, Jeffrey, a science teacher, and Maria, a nurse, instilled in him a deep appreciation for education and service. Growing up with two brothers in a small town, he developed a strong sense of family and discipline.

He attended Carroll College, where he discovered a passion for human performance and resilience. It was there that he met his wife, Rebecca, whose support and encouragement helped guide him toward a career in medicine. He went on to attend the University of Washington School of Medicine in Seattle, where his interest in orthopaedics solidified.

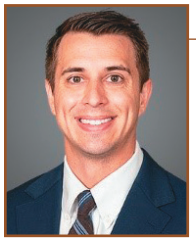
Matching into orthopaedic surgery at UT Health San Antonio was key to development both his professional and personal life. During residency, he and Rebecca welcomed their son, Lincoln, marking the beginning of their growing family. He remains deeply grateful to his mentors, who have played a crucial role in his development as a surgeon.

With a growing passion for spine surgery, Ezekial is excited to continue his training with a fellowship at OrthoCarolina, in Charlotte, NC, eager to refine his skills and contribute meaningfully to the field and his patients.

Kathleen Lundquist, MD

Kathleen was born and raised in Fort Worth, Texas. She is the only child of Craig and Julia Lundquist who have been instrumental in her education through the years and are her biggest supporters. She grew up an avid tennis player and proceeded to play on the women's undergraduate tennis team at Trinity University in San Antonio, TX where she graduated with a Bachelor of Arts in Spanish and a minor in Biology. She went on to attend Texas A&M University College of Medicine where she was inducted into the Alpha Omega Alpha (AOA) and Gold Humanism Honor Societies and graduated with honors. She was ecstatic to move back to San Antonio to continue her medical training in orthopaedic surgery at UT Health San Antonio. She will forever be thankful for the surgical training, mentors,

and lifelong friends she gained during residency. This coming year, Kathleen will be completing a fellowship in Adult Reconstruction at the Hospital of the University of Pennsylvania. Following fellowship, she plans to return to Texas to practice.



Sam Ornell, MD

Sam Ornell was raised in Coppell, Texas and completed his undergraduate studies at the University of Oklahoma. He returned across the Red River to attend medical school at The University of Texas Health Science Center San Antonio, becoming the first physician in his family. During medical school he completed a year-long research fellowship with the Department of Orthopaedics at UT Health San Antonio, broadening his involvement in the field and fostering his interest in orthopaedic trauma. He is grateful to have matched at UT Health San Antonio where he has learned from excellent faculty across all subspecialties. He has truly valued his time in San Antonio and is proud to be a graduate of such a historic and exceptional program. Sam will continue his orthopaedic training with a fellowship in orthopaedic trauma at the Florida Orthopaedic Institute in Tampa, FL. He is forever grateful for the loving support of his parents, Steve and Denise.

Loc-Uyen Vo, MD

Loc-Uyen was born and raised in Houston, Texas, alongside her siblings and built-in best friends, Quan and Nani. She is the proud daughter of the two most inspirational and hardest working people she knows, her dad and mom, Toai and Hanh Vo. Loc-Uyen went to the University of Texas at Austin, where she obtained her Bachelor of Science degree, and later Master of Public Health, graduating Summa Cum Laude. She then took her Texas life out west to Texas Tech University Health Sciences Center El Paso for medical school, where she was inducted into the Alpha Omega Alpha (AOA) Honor Medical Society and Gold Humanism Honor Society. Upon graduating, she became the first physician in her family. Over the past 5 years, she has had the privilege of completing her orthopaedic residency training at UT Health San Antonio. She is grateful for the opportunity she has had to learn from the passionate, knowledgeable, and skilled faculty and mentors in San Antonio, as well as the distinct honor of serving as Administrative Chief Resident, as selected by her program. In the coming year, she will be completing her orthopaedic trauma fellowship at the Hospital for Special Surgery (HSS) in New York City.

Orthopaedic Residents 2024-2025

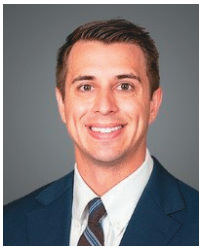
PGY 5 2020 - 2025

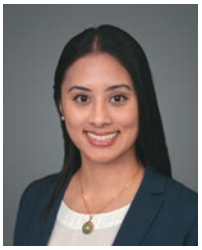

Annat Houston


Stephanie Jones


Ezekial Koslosky


Kathleen Lundquist


Sam Ornell


Loc-Uyen Vo

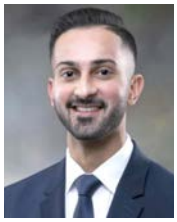
PGY 4 2021 - 2026


Travis Bullock


Jordan Carter


Andrew Eck


Chimobi Emukah


Ahmed Makhani


John Parker


William Young

PGY 3 2022 - 2027


Doha Hussien

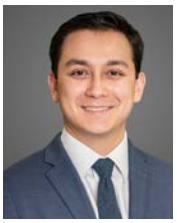

Zachary Jodoin


Casey McDonald


Mallory Ogburn


Kyle Paul


Elizaveta Reznichenko


Luke Verlinsky

PGY 2 2023 - 2028


Cameron Atkison


Brandon Driggs


Morgan Gable


Deshaun Holdipp


Mauricio Valdez

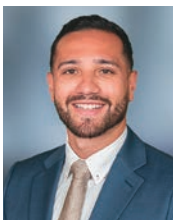

Abigail Wheeler


Tyler Williamson

PGY 1 2024 - 2029


Eric Cal


Coltin Gerhart


Victor Martinez


Jason McCartney


Katerina Papanikolaou


Abhi Rashiwala


Jordan Robbins

03

Clinical Divisions

Adult Reconstruction

Frank A. Buttacavoli, MD

The adult reconstruction service continues to grow in size and reputation; meeting the needs of the city of San Antonio and the surrounding region with high quality outcomes and quality of life improvement for our patients.

Robotics and AI have become an integral part of patient care. The new Multispecialty and Research Hospital (MSRH) is equipped with the latest and greatest technologies to offer to our patients. We started taking care of patients at our new facility in late 2024 and the response from our patients has been remarkable. We expect MSRH to be the top spot for the regions future joint replacement needs.

The department is growing to meet the needs of the region. We have two new faculty starting in September 2025. Jacob Brennan, one of our former residents, will be joining us following his fellowship at the University of Virginia. Zack Clarke will be joining us from the esteemed Anderson Clinic. Given the growth in volume and faculty we plan to add a fellowship program through the ACGME in the near future. The service currently has two residents and we are therefore confident a fellow would not deter from resident education. We are also eager to hire a fifth faculty for the division when the timing is right.

On the research front we have one current industry sponsored clinical trial looking at a novel antibiotic bead. We are evaluating its potential as an antibiotic eluting agent while also providing structural support at the time of reimplantation following previous resection arthroplasty. We are a large referral center for complex periprosthetic issues and have a significant amount of pathology to evaluate these complex issues.

The group was very prolific this year with many publications and poster presentations at AAHKS, AAOS, Orthopedic Summit, and Mid America meetings. The adult reconstruction team totaled eight article publications, seven papers in submission, four podium presentations, and 14 posters. The hard work of the residents, medical students, and faculty has led to the most prolific year for hip and knee research for our department. I will also begin a second term on the AAOS adult reconstruction evaluation committee this spring.

We continue advertising for an open position for the adult reconstruction service. We are eager to welcome Dr. Zachary Clarke after his fellowship at Anderson Clinic. He will join myself and Dr. Chance Moore currently on faculty. We are looking to round out the team with a total of four to five fellowship trained surgeons.

The future continues with promise for joint replacement growth in our department. We have seen a growth in interest in the subspecialty within the residency. We have four current upper level residents continuing their education with joint replacement fellowships. Current chief resident, Kathleen Lundquist, will be a fellow at the University of Pennsylvania in the fall.

The department is excited to continue to provide for future patients and resident education opportunities for life changing minimally invasive anterior hip and robotic knee procedures. **Come get your life back with the help of the UT Health San Antonio adult reconstruction team!**

Foot & Ankle Surgery

Mayo J. Galindo, Jr., MD

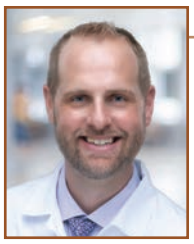
Our Foot and Ankle division is currently staffed by Mayo J. Galindo, Jr., as a full-time faculty. Our residents are also outsourced in the private sector with Mark M. Casillas, MD.

As PGY 3's, in their seven-week rotation, our residents are exposed to common foot and ankle problems and also to low-energy trauma. Complex reconstructions have become the norm.

Diabetic foot salvage challenges are also part of their experience. Dr. Casillas offers a wealth of experience in total ankle replacement surgery. Our residents are also exposed to ankle and hindfoot arthroscopy, sports injuries, sports reconstruction, and sports rehabilitation.

Two of our current residents, Annat Houston, MD, and Stephanie Jones, MD have matched with high quality foot and ankle fellowships to further their career paths. Shane Bullock, MD is in process of applying for foot and ankle fellowships.

In the past, we have hosted residents from a sister school in Monterey, Mexico. We are open to continuing that relationship. Our post-pandemic surgical caseload has stabilized. At the time of this writing, we are also seeking full-time staff to expand our "footprint."



Hand Surgery

Ryan Rose, MD

The Orthopedic Hand Service continues to thrive in its endeavor to provide high quality hand and reconstructive care to the residents of San Antonio and Bexar County, led by Drs. Fred Corley, Ryan Rose, Brian Sager, Christina Brady and Jason Coffman. Of course we could not do this without being supported by our outstanding staff and specialists.

Dr. Rose, our Chief of Hand Surgery, continues to strengthen our outstanding residency program, serving as the Residency Program Director. In addition to his administrative roles, Dr. Rose serves as the primary Hand and Upper extremity provider at the Medical Arts and Research Center. In

the last year, Dr. Rose has also presented on the podium at the annual meetings of the Texas Orthopedic Association (TOA) and the American Society for Surgery of the Hand (ASSH).

Dr. Corley remains steadfast in providing excellent clinical care to the patients at the Robert B. Green facility and he continues to be instrumental in teaching the residents at our Monday Grand Rounds.

Dr. Sager continues to serve the San Antonio community at his clinical locations at Metropolitan Methodist and UT Health San Antonio Hill Country. He has been increasingly more involved in local and national societies, presenting at the TOA, San Antonio Annual Sports Medicine Symposium and the ASSH. In addition, he, along with Dr. Rose, once again served as faculty for the annual ASSH fellows bootcamp.

Dr. Brady continues to provide outstanding leadership in her role as Chief of Orthopedic Surgery at the Veterans Affairs Hospital. In addition to her clinical and administrative work, she continues to publish high-quality research.

Dr. Coffman, now in his second year with the department, has been increasing his clinical presence at the new UT clinic and surgery center at Kyle Seale Parkway. He has also been increasingly involved in resident didactic education.

As the upper extremity division continues to expand our footprint in the San Antonio community, our commitment to providing high quality care, training the future of Orthopaedics remains unwavering. We are excited to provide care at the new UT Health San Antonio Multispecialty and Research Hospital. On a sadder note, we said goodbye to our long-time colleague Dr. Douglas Cromack this year who retired from UT Health San Antonio. His care and dedication to the people of San Antonio will be missed tremendously and we wish him the best of luck in the future!

Oncology

Joseph Alderete, Jr., MD

The UT Health San Antonio Orthopaedic Oncology division continues to lead as the only comprehensive orthopedic oncology *system* in South Central Texas, providing specialized care for bone and soft tissue tumors affecting the extremities, pelvis, spine, and chest wall. Our multi-disciplinary approach to sarcoma, metastatic bone disease, advanced amputee care, and complex limb salvage remains a model for institutions nationwide. Our team, led by Dr. Robert Quinn, Dr. Joseph Alderete, Jr., and PA Ashlee Blume, serves as the "quarterbacks" of a sophisticated care network, ensuring precision care for patients with complex diseases, defects, and deformities.

The division continues to advance in precision oncologic surgery, utilizing minimally invasive procedures, limb-sparing surgeries, complex joint reconstructions, and targeted tissue removal. Our integration of the Brain Lab system showcases our commitment to maximizing functional outcomes while minimizing damage to healthy tissue. The team has also incorporated the latest systemic treatments, including targeted therapies and immunotherapy based on tumor genetics, offering personalized and effective treatment options for our patients.

Comprehensive pain management strategies remain a priority, utilizing new advancements in psychedelics (ketamine), regional blocks, cannabinoids, and anti-depressants to reduce narcotic use and promote early rehabilitation. We've also introduced a private pain and stress psychotherapy group to support the emotional well-being of our cancer and limb-loss patients. Our rehabilitation programs leverage insights from DoD Combat Injury rehabilitation, incorporating visuo-spatial integration (video game therapy), Blood Flow Restriction (BFR) therapy, and the Alter-G treadmill to enhance recovery and optimize function.

A standout initiative this year is the launch of Dr. Alderete's osseointegration program, bringing his expertise from the Department of Defense to UT Health San Antonio. This innovative program offers advanced prosthetic integration, promoting new levels of independence for amputee patients. PA Ashlee Blume has taken the lead as the osseointegration service chief, coordinating care among physical therapy, occupational therapy, behavioral health, prosthetics, and the surgical teams of plastic surgery and orthopaedic oncology. Her leadership has been instrumental in establishing this new service line.

With the new UT Health San Antonio Multispecialty and Research Hospital now open, the division is well-positioned to expand its capacity for oncology procedures within this state-of-the-art facility. The orthopaedic oncology team remains dedicated to delivering expert multi-disciplinary care for bone and soft tissue sarcomas, benign tumors, metastatic tumors, metabolic bone disease, and limb salvage.

Orthopaedic Trauma

Thomas L. Hand, MD, FAAOS

It's been another productive and meaningful year for the Orthopaedic Trauma Division at UT Health San Antonio. Our clinical team includes five fellowship-trained orthopaedic trauma surgeons—Drs. Animesh Agarwal, Thomas Hand, Ravi Karia, Case Martin, and Boris Zelle—along with Dr. Anil Dutta, specializing in shoulder and elbow surgery. We're also fortunate to work alongside four outstanding advanced practice providers: Christopher DeLallo (MPAS, PA-C), Jennah Jorge (MPAS, PA-C), John Kodosky (DHSc, MPAS, PA-C), and Priscilla Gomez-Ramos (DMSc, MPAS, PA-C). Supporting our team are Jennifer Aguilar (RN, research nurse), Anna Conti (Senior Administrative Assistant), and Monica Ramirez, CPC (Surgical Care

Coordinator), who each play a key role in keeping things running smoothly.

Our division continues to handle some of the most complex orthopaedic injuries in the region—often life- or limb-threatening cases—while maintaining strong surgical volume and clinical productivity. Over the years, we've built a reputation for delivering high-quality care in challenging situations. More recently, we've expanded our reach into private hospitals across San Antonio. In addition to our long-standing presence at University Hospital, our team provides call coverage at Main Methodist, Methodist Specialty & Transplant, Methodist Metropolitan, Mission Trail Baptist, and Baptist Medical Center.

Education remains a cornerstone of what we do. All rotating medical students spend part of their training on the trauma service, and orthopaedic residents complete multiple trauma rotations during their residency. The trauma rotation remains one of the most robust and dynamic experiences in the program, offering residents exposure to a high surgical volume, hands-on experience, and complex cases that prepare them for independent practice. Our OTA-accredited trauma fellowship also continues to grow and attract top-tier candidates nationally.

On the research side, our division has played a leading role in advancing orthopaedic research at UT Health. We've built a strong, well-funded program supported by grants from industry, private foundations, internal sources, and the Department of Defense.

Thank You, Dr. Boris Zelle: Honoring a Remarkable Journey at UT Health San Antonio

We share with sincere appreciation that Boris A. Zelle, MD, MBA, FAAOS, FAOA, will be leaving UT Health San Antonio in September 2025 to join UT Medical Branch (UTMB). Dr. Zelle has been a core member of our faculty since 2011 and has played an important role in the evolution of the Division of Orthopaedic Trauma over the past 14 years.

Dr. Boris A. Zelle receiving the 2024 UT Presidential Excellence in Service Team Award, handed by Interim President Dr. Robert Hromas.

Dr. Zelle relocated to San Antonio with his wife Ana and their children, Julia and Matteo, after completing his training and early career in Pittsburgh, PA. He quickly became a integral part of our trauma team, serving patients throughout the region with a strong commitment to clinical care.

Alongside his clinical work, Dr. Zelle cultivated a research program with a focus on health disparities in orthopaedics, social determinants of health, and nutrition in vulnerable populations. His work has been supported by funding from industry partners, foundations, and the Department of Defense, and has contributed to ongoing national conversations about equity in orthopaedic care.

Dr. Zelle has also been active in resident education, both within UT Health and through national organizations like AO and OTA. In 2017, he launched the Orthopaedic Trauma Fellowship and has served as Program Director since its inception, mentoring many trainees as they advanced into subspecialty training. Internationally, he helped facilitate exchange opportunities and hosted several visiting fellows, further expanding the reach of our program.

In addition to his clinical role, Dr. Zelle served as Division Chief of Orthopaedic Trauma and Vice Chair of Research. Under his leadership, the division was recognized with the 2024 UT Presidential Excellence in Service Team Award (Figure 1). His research on health disparities has earned national recognition, including the 2022 OTA DEI and Health Disparities Research Award and the 2024 AAOS Diversity Award.

As Dr. Zelle prepares to transition to his new role, we thank him for his service, contributions, and commitment over the years. We wish him and his family continued success in the next chapter of his career at UTMB.

Pediatrics

Sekinat McCormick, MD

The Pediatric Orthopaedic Division has had an exciting and productive year, continuing to grow and expand its impact within the state-of-the-art Women's and Children's Hospital at University Health. Our team remains dedicated to providing comprehensive care for a wide range of pediatric orthopaedic conditions while also engaging in education, research, and community outreach.

Dr. Anigian has become busy managing scoliosis and a variety of pediatric orthopaedic conditions, including deformity, trauma, and cerebral palsy. She plays a key role in the new Spine Center and serves as the pediatric orthopaedic trauma liaison for University Hospital. She recently lectured at the Sports Symposium on adolescent spine injuries, helping to advance knowledge in the field.

Dr. Gibbons continues to provide outstanding care in pediatric sports, trauma, and deformity. As Associate Program Director for the Orthopaedic Department, he actively mentors medical students pursuing careers in orthopaedics and supports Dr. Rose in his program director duties. He also serves as the Medical Director of the MARC Orthopaedic Clinic, focusing on patient access and satisfaction. This year, he was promoted to Associate Professor and awarded the Kaye Wilkins Endowed Professorship. In the spirit of giving back, he led a group of residents during the holidays to dis-

Annual Galentine's Day brunch attendees at Ida Claire.

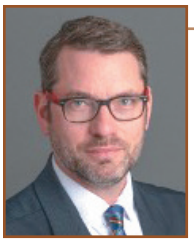
tribute gifts to pediatric orthopaedic patients at the hospital. He also continues to contribute nationally, lecturing annually at the AAPA Musculoskeletal Galaxy for the pediatric ortho review.

Dr. McCormick remains passionate about inspiring the next generation of orthopaedic surgeons. She, alongside faculty, residents, and medical students, volunteered at multiple hands-on labs to introduce students to the fundamentals of suturing, drilling, and casting. The most memorable patients of the year were undoubtedly the teddy bears who received expert orthopedic care!

In addition to her educational outreach, Dr. McCormick served as the faculty sponsor for a Community Engagement Learning (CEL) project led by medical student Andrew Wright (Class of 2027). With support from the Charles E. Cheever Jr. Center for Medical Humanities and Ethics, their "Pitching Health Initiative" introduced an arm care program to parents during their children's baseball practices. With promising early results, they plan to continue this important work and share their findings in the future.

This year also marked the annual Galentine's Brunch, hosted by Drs. McCormick, Anigian, and Brady, celebrating the strong community of women in orthopaedics.

The division looks forward to continued growth, advancing patient care, and furthering the education of residents and students. We are always happy to see patients same-day or next-day for any pediatric orthopaedic concerns, ensuring that children receive timely and expert care.



Podiatry

Lee C. Rogers, DPM, FFPM RCPS (Glas) Chief Division of Podiatry

Attending Faculty

Lee C. Rogers, DPM, Division Chief
Professorship in Podiatric Medicine and Surgery
Robert G. Frykberg, DPM, MPH, Residency Program Director
Ian Barron, DPM, Associate Program Director
*Collin Pehde, DPM, Amputation Prevention Fellowship Director**
Professorship in Amputation Prevention
Cyaandi Dove, DPM, Director of Clinical Research
Lawrence A. Lavery, DPM, MPH, Research Fellowship Director
Kimberly Barron, DPM
Alexander Blaschke, DPM
Arthur Tarricone, DPM, MPH
Karla Tarricone, DPM

Education

The Division is home to one of the oldest podiatry residencies in the country (1972), and the first residency in an academic medical center. The Podiatric Medicine and Surgery Residency (PMSR) is a 3-year program approved by the Council on Podiatric Medical Education (CPME). The UT Health San Antonio PMSR accepts 3 residents per year for a total of 9 residents. Dr. Robert G. Frykberg has joined the Division as the new residency program director. Dr. Frykberg served as residency director of the Phoenix VAMC podiatry residency program for 20 years.

The Division offers one of the oldest fellowships in podiatry (1993). The Amputation Prevention and Research Fellowship accepts two post-graduate fellows per year and recently became approved by the CPME. The fellowship focuses on diabetic foot reconstruction, including orthoplastics, Charcot foot, and external fixation techniques. The 2023-2024 fellows are Hoa Phan, DPM and Amir Alikhani, DPM. Additionally, the Division has a research fellow who spends one year focused on podiatry-related research. The research fellow for 2024-2025 is Ahmad Nezameslami, MD. The Division receives students from all US podiatry schools for externships averaging 4-6 students per month.

The Division raised over $350,000 in educational grants, primarily aimed at fellowship training, over the past two years.

Clinical Activities

The Division's clinical work includes inpatient services at University Hospital (UH) and outpatient services at Texas Diabetes Institute (TDI), the UT Health San Antonio Medical Arts and Research Center (MARC), and UT Hill Country. In

2024, the Division is expanded to provide coverage at UT Kyle Seale Parkway and a new San Antonio southside clinic in a partnership with vascular surgeon Lyssa Ochoa, MD, as well as a consistent resource podiatrist to the San Antonio Spurs. The residents are involved in training and clinical work at the Audie L. Murphy VA Medical Center with 5 additional adjoint faculty.

Research Activities

The Division started several important research studies in 2024 on diabetic foot ulcers, soft tissue infections, osteomyelitis, and limb threatening ischemia. Notably, the Division has taken a leading role in the US in understanding the mechanism of action of a reported Chinese procedure called "transverse tibial transport" (TTT), which was renamed by UT faculty as tibial osteodistraction angiogenesis (TODA). The procedure involves creating a unicortical, rectangular osteotomy of the anteromedial tibia and connecting it to an external fixator with a motor. The bone fragment is distracted 1 mm/day for 10 days, then reduced in reverse order for 10 days. The procedure is indicated in "no-option-vascular" patients who have poor perfusion to the foot and no traditional revascularization options exist. The Division just completed a meta-analysis of the Chinese literature which included >2000 patients and showed robust reperfusion of the extremity leading to limb salvage. Dr. Arthur Tarricone and Dr. Lawrence Lavery submitted a grant for NIH funding to better understand the procedure, indications, and outcomes.

CME Programs

The TEXFIX conference was a successful rebranding of the International External Fixation Symposium (IEFS), now in its 17th year and offers a mix of didactic and cadaver practical workshops and focuses on basic principles of foot and ankle surgery with external fixation. TEXFIX is presented by UT Health San Antonio and co-chaired by faculty Dr. Collin Pehde and Dr. Lee Rogers. The conference has hosted surgeons from 32 countries for unparalleled surgical training on the diabetic foot and ankle. UT Health San Antonio gives the Ilizarov Award of Excellence at the conference. The 2024 recipient was Dr. Michael Theodoulou from Cambridge Health in Boston, MA. The conference website is www.texfix.org.

The Great Debates and Updates: Diabetic Foot (GDUDF) completed its third and was held in Dallas on December 6-7, 2024 at the Gaylord Texan. The GDUDF was chaired by faculty Dr. Lee C. Rogers and Dr. Lawrence A. Lavery and focused on evidence-based treatments and multidisciplinary team approach to the complicated diabetic foot. UT Health San Antonio gives the Harkless Leadership Award at the GDUDF. The 2024 recipient was vascular surgeon Joseph Mills, MD from Baylor Medical College in Houston, TX. In 2025, the UT called the Diabetic Foot Update, a namesake conference hosted by UT Health San Antonio from 1983-2007, will return to San Antonio on December 6-7, 2025 and this year the theme is the diagnosis, medical and surgical treatments for the Charcot foot.

In addition to the aforementioned UT Health San Antonio-sponsored events, Division faculty lectured at more than 30 international, national, and regional conferences, including the American Diabetes Association, the American College of Cardiology, the Diabetic Foot Global Conference (DFCon), and the Global Podiatry Summit.

New Faculty

The Division recruited several top faculty in 2024, including Lawrence A. Lavery, DPM, MPH, Robert G. Frykberg, DPM, MPH, Ian Barron, DPM, Kimberly Barron, DPM, Arthur Tarricone, DPM, MPH, and Karla Tarricone, DPM. The new faculty add a range of clinical, surgical, and research expertise to the Division. The new faculty biographies are included in this edition of the SAOJ.

Dr. Collin Pehde – Lee J. Sanders Professorship in Amputation Prevention

Dr. Collin Pehde was selected by the Department of Orthopaedics as the Lee J. Sanders Professor in Amputation Prevention. The endowment provides funding for research and academic endeavors focused on preventing amputations in diabetes. Dr. Pehde has used funding from the endowment to purchase new dynamic peak plantar pressure hardware and software.

Publications

In 2024, the Division published 36 peer reviewed manuscripts, many in high impact factor journals including *The American Journal of Cardiology, Diabetes Care, and Wound Repair and Regeneration*. Faculty were lead authors on two important guideline documents for *The Standard of Care in Diabetes* published in *Diabetes Care* and *The WHS Diabetic Foot Ulcer Guidelines* published in *Wound Repair and Regeneration*. Division faculty also published four chapters in resource textbooks such as *Rutherford's Textbook of Vascular Surgery*. For the full list of publications, see pages 33–38.

Extramural Leadership

Dr. Lee C. Rogers – Vice President, International Federation of Podiatrists (FIP), Immediate Past President, American Board of Podiatric Medicine (ABPM)

Dr. Lee C. Rogers was elected to his first term as Vice President of the International Federation of Podiatrists (FIP - Federation Internationale des Podologues) in 2024. FIP was founded in 1947 and represents over 40,000 podiatrists from 22 member countries. In 2024, FIP hosted the Global Podiatry Summit (GPS) with Rogers leading the conference in Reykjavik, Iceland. GPS started with a welcome speech by His Excellency Gudni Johannesson, President of Iceland. The conference also celebrated a keynote lecture by Dr. Robert Quinn, Chair, Department of Orthopaedics.

Dr. Rogers completed his term as President of the American Board of Podiatric Medicine (ABPM), one of the two

recognized certifying boards in podiatry which has 6400 Diplomates of 18,000 podiatrists in the US. He advances to the *ex officio* Board of Directors position of Immediate Past President for two years. Rogers has served on the Board of Directors for 10 years and during his presidency, he oversaw restructuring of the board, authored the Board's guide on hospital privileges for podiatrists, founded the ABPM's international certification, founded the ABPM's certificate of added qualification (CAQ) program, and was the architect of the Board's relationship with the Royal College of Physicians and Surgeons of Glasgow (RCPSG), creating a pathway to fellowship in the Royal College for American Diplomates. Rogers also was the lead plaintiff in the Board's successful litigation against the Oregon Medical Board in the state's appellate court for discriminating against podiatrists' access to perform ankle surgery.

Dr. Lawrence A. Lavery – Chair, Diabetic Foot Interest Group, American Diabetes Association (ADA)

Dr. Lawrence A. Lavery was selected to be the Chair of the Diabetic Foot Interest Group of the American Diabetes Association (ADA). The Foot Interest Group is one of 16 professional leadership teams. He will serve as chair-elect for one year before advancing to the position of chair. In this position, he will be principally responsible for planning the ADA Scientific Sessions, plan webinars and networking events, and provide content to share with other group members.

Dr. Cyaandi Dove – Board of Directors, American Limb Preservation Society (ALPS)

Dr. Cyaandi Dove was elected to the Board of Directors of the American Limb Preservation Society (ALPS), a prestigious, multidisciplinary organization led by former UT Health San Antonio Division faculty David G. Armstrong, DPM, MD, PhD. ALPS brings together the foremost experts in vascular surgery, podiatry, endocrinology, and wound care to advance limb preservation through research, innovation, and advocacy. This appointment reflects a shared commitment to reducing preventable amputations and addressing health disparities in lower-extremity care.

Shoulder & Elbow

Anil K. Dutta, MD

The Shoulder and Elbow Service has continued Dr. Charles A Rockwood's legacy, remaining one of the most and comprehensive and advanced shoulder and elbow centers in North America. The current full-time UT Health San Antonio shoulder and elbow faculty are Dr. Bernard Morrey, Dr. Anil Dutta, Dr. Ian Whitney, and Dr. Phil Jacobs. The clinical adjunct faculty are Dr. Robert Hartzler, Dr. John Hinchey, and Dr. Travis Burns. The division has emphasized a balanced approach to trauma, joint reconstruction, and sports medicine in both the shoulder and elbow.

Dr. Morrey has led the fellowship to set a new standard in the American Shoulder and Elbow Society and will be retiring from clinical practice but maintain and adjunct role as senior consultant in research and education while staying deep in the heart of Texas at his ranch in La Grange. We have had a series of successful graduates under his guidance with our last fellow Eric Johnson establishing practice in Oklahoma City in an orthopedics specialty group. He has already assumed a role as their tertiary shoulder and elbow specialist and for the community. Out past two fellows Tammam Hanna, MD and Jongmin Kim, MD joined academic centers at Texas Tech and the University of Florida, respectively. The prior fellow Vaibhav Kanawade, MD will be affiliated with the emerging UTRGV Orthopedic program. We are excited to see these graduates spread the knowledge and skills of the UT Health San Antonio program into other orthopedic teaching programs.

Dr. Dutta is the current senior clinical surgeon and continues his work in shoulder and elbow reconstruction with an emphasis on elbow replacement, revision, and design. He continues to work with the Hospital for Special Surgery in their development of a new total elbow system. He is currently working with Zimmer Biomet on a new shoulder replacement revision design and on humeral and clavicle market analysis studies as well. His academic work includes book chapters on elbow fusion and shoulder sepsis and two publications on humeral fracture care.

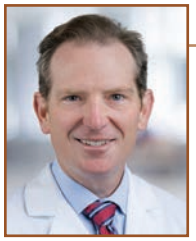
Dr. Ian Whitney, a graduate of our program, completed his fellowship with Dr. Rockwood's longtime colleague and co-author, Dr. Rick Matsen. He continues to grow his practice in both shoulder and elbow comprehensive care as well as in adult reconstruction and sports. He has developed a complex tertiary care practice that includes extending care to the major private centers in San Antonio and beyond. Ian has also developed unique strategies in the treatment of shoulder revision and is working with Stryker on both shoulder and elbow reconstruction design and techniques as well as the use of virtual reality and navigation in shoulder arthroplasty. He is of the first surgeons in the region to use a pyrocarbon shoulder design for shoulder arthritis. He is also one of the lead surgeons on the use of robotics in shoulder arthroplasty implantation. He remains an active participant in the care of college (UTSA) and high school sports as well.

Dr. Jacobs, both a Rockwood and Christian Gerber fellow, continues his leadership with shoulder surgery and sports medicine. He is one of the key members of the UTSA sports coverage team. He continues his investigative work with research on the rotator cuff disease and arthroplasty and has a recent publication with Hugo Giambini, PhD in the Journal of Bone and Joint Surgery on rotator cuff biomechanics.

The division had the pleasure to also welcome and host multiple legendary figures in shoulder and elbow surgery in

the past year. This included a visit from Cristian Gerber who delivered grand rounds and a resident teaching conference in September 2024. Dr, Whitney participated in a teaching conference with the Gilles Walch, MD in Austin, TX in January of 2025. Additionally, the program will be hosting Frederick Matsen in April of 2025.

Our current fellow Matthew Glazier, DO has been an outstanding member of our academic department this year and has worked on several projects including Humeral nonunion and scapular fracture techniques. He will be jointing the local TSAOG and VA group, and we are excited to continue our partnership with him in the years to come.



Spine

Christopher Chaput, MD and Jeff Hills, MD

Ortho Spine Making Big Impact on Deformity Surgery Goals and Patient Outcomes

Dr. Hills, Assistant Professor of Orthopedic Surgery, has gained international recognition, particularly for his work on sagittal alignment in adult spinal deformity. His description of the 'T4-L1-Hip Axis' has redefined sagittal realignment targets, challenging historical alignment concepts such as PI-LL mismatch. In collaboration with a multinational study group, he established normative spinal alignment in asymptomatic individuals, followed by extensive work with the International Spine Study Group (ISSG) to translate these findings into new surgical realignment targets. His study, *The T4-L1-Hip Axis: Sagittal Spinal Realignment Targets in Long-Construct Adult Spinal Deformity Surgery: Early Impact*, was published in *The Journal of Bone & Joint Surgery* in 2024 and is poised to become a landmark study in the field. Further validation through his collaborative work with the European Spine Study Group (ESSG) has reinforced the clinical relevance of these alignment principles. Through a combination of precise statistical analysis and biomechanical insights, Dr. Hills has deepened the field's understanding of sagittal balance. His findings are refining surgical strategies to improve long-term outcomes and reduce mechanical complications in complex deformity surgery.

At UT Health San Antonio, Dr. Hills recently completed a Master of Science in Clinical Investigation (MSCI) and continues to lead research in spine biomechanics. His study, *A Geometrical Explanation for Change in Pelvic Tilt*, published in *Spine* in 2024, provided a mechanistic explanation for changes in sagittal balance following long spinal fusions. The findings have been independently validated across multiple institutions, reinforcing their clinical significance. Additionally, Dr. Hills has initiated a collaboration with Dr. Hugo Giambini at UTSA, focusing on biomechanical simulations to optimize surgical alignment planning. This initiative aims to develop patient-specific spine models that simulate different alignment strategies preoperatively, allowing for individualized, biomechanically optimized surgical planning.

Dr. Hills' contributions have earned multiple awards and invitations to present his findings at leading international spine meetings. He received the Best Paper Award at the 9th International Spinal Deformity Symposium for his research on high-risk patients for PJK with a lower thoracic UIV and was named Star Educator by the Academy of Educational Scholars at UT Health San Antonio Long School of Medicine. Over the past year, he has been invited to give Grand Rounds at the San Diego Spine Foundation, NYU Spine Fellowship, USF Spine Fellowship, and the Vanderbilt Medical Center (upcoming). In addition, he has served as faculty at several premier spine meetings, including the 10th International Spinal Deformity Symposium in New York, the Sagittal Alignment Think Tank in New York, the NASS Evidence-Based Medicine Webinar Course, IMAST 2024 in San Diego, the AANS Spine Summit, and the 2025 TMC Spine Rodeo Conference in Houston (upcoming).

Looking ahead, Dr. Hills is committed to advancing precision medicine in adult spinal deformity surgery. His current research focuses on integrating biomechanical simulations with predictive modeling to generate more precise, patient-specific surgical plans. With a forward-thinking approach, Dr. Hills continues to shape the future of spinal deformity surgery through data-driven innovation and interdisciplinary collaboration.

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In the News

This article originally appeared in Mission*, the flagship magazine of UT Health San Antonio, illuminating vital and innovative advancements in education, research and healing at the university.*

A retired orthopaedic surgeon puts his trust in a former colleague to address his chronic back pain

John Toohey, MD, retired orthopaedic surgeon and former assistant dean at UT Health San Antonio, spent decades repairing spines and restoring hope.

As a retired orthopaedic surgeon and former assistant dean in the Department of Graduate Medical Education at UT Health San Antonio, Toohey guided countless patients through the maze of chronic back pain, treating them with precision and compassion.

But at age 74 — when spinal stenosis left him with his own excruciating pain and few options — the healer became the inaugural patient at the newly opened UT Health San Antonio Multispecialty and Research Hospital.

"You know how it feels when you hit your funny bone?" Toohey asked. "The pain was so bad. I couldn't do anything. I'm an avid golfer, but I couldn't play anymore. I couldn't walk. I couldn't hike. I used to bike all the time, but I couldn't even do that."

For years, Toohey fought to keep his symptoms under control. Anti-inflammatory medications, physical therapy and a regimen of epidural steroid injections provided temporary relief. But by last summer, even the injections couldn't keep him on the golf course.

"I had tried everything," he said. "For someone who was relatively fit, I had become a slug."

Making the call for help

The surgeon who had spent his life mending others knew it was his turn to seek help. He placed his trust in the people and institution he believed in most.

"I made an appointment at The Spine Center," he recalled. "I showed up at the office with my MRI and said, 'I need surgery. Let's get on with it.'"

Spine surgeon

Christopher Chaput, MD, director of The Spine Center at UT Health San Antonio's Medical Arts and Research Center, performed the inaugural surgery — on a former colleague — at the university's newly opened Multispecialty and Research Hospital, where Chaput also serves as chair of the Department of Orthopaedics.

That office is led by Christopher Chaput, MD, who worked alongside Toohey years earlier and now serves as chair of the Department of Orthopaedics at UT Health San Antonio's new hospital. Chaput is also the director of The Spine Center located at the UT Health Medical Arts and Research Center.

"I was really surprised when I showed up to my clinic a few months ago and my first patient of the day was my former spine partner here at UT Health San Antonio," Chaput said. "He didn't warn me that he was coming back to see me about his back."

For Toohey, the decision to turn to Chaput was more than just familiarity. It was about confidence. He knew the rigorous standards required to be a truly skilled spine surgeon, and Chaput had earned that distinction.

"A good spine surgeon doesn't jump to surgery. They exhaust conservative treatments first and recognize that surgery isn't always the answer," Toohey said. "You have to assess the patient as a whole and determine what's really best for them. There are plenty of cases where surgery isn't the right option."

So, when Chaput proposed the same surgical approach Toohey had championed for years, Toohey immediately knew he had found the right surgeon.

"I thought, 'That's good news. Now I don't have to walk him through the surgery in the [operating room],'" he said, laughing. "I've been at this long enough to know exactly what needed to be done."

A milestone for UT Health San Antonio

Toohey's procedure, a two-level lumbar decompression and fusion, is routine in spine care. But for Robert Quinn, MD, chair of the Department of Orthopaedics at UT Health San Antonio and a hospital board member who hired both surgeons, the surgery marked a significant milestone.

"The first case performed at [the new hospital] — a surgery by Dr. Chaput on Dr. Toohey — really speaks to the strength of our team and the caliber of care we provide," Quinn said. "Having John place his trust in Chris shows just how much confidence we have in our physicians, and it's a testament to the level of expertise that exists here."

Facing the unknown

Like any patient, Toohey was apprehensive before surgery.

"I know all too well what can go wrong. Believe me, I've had things happen that are out of your control," he said, his wife Myrna by his side. "But you have to have faith in people and trust that the institution has good doctors. I was apprehensive, but I wasn't losing sleep over it. The only thing keeping me up at night was the pain in my back."

For Chaput, Toohey's confidence was both an honor and a challenge.

"I wake up every day thinking about how we can improve care," Chaput said. "With the new hospital, we have the opportunity to continue setting a new standard for South Texas."

Chaput knows firsthand how the new hospital's mission extends beyond technological advancements. At its core, he said, are the people — their skill, dedication, compassion and

teamwork.

"As a surgeon, there's only so much I can do with my own two hands," Chaput said. "What many patients don't realize is how crucial the team behind those hands really is. I've come to know the nursing and anesthesia teams well, and their expertise gives me the confidence to honor the trust my patients place in me."

Jeff Flowers, MBA, FACHE, chief executive officer of the hospital, agreed.

"Our hospital's mission is rooted in hope and healing, but it's our core values — service, integrity and teamwork — that set us apart," he said. "By fostering a culture of collaboration across every discipline, it ensures every decision is made in the best interest of our patients and their families. It's not just what we do, it's who we are."

A full-circle moment

The day of the surgery, Dec. 10, was full of personal meaning. In addition to being the first patient at the new hospital, Toohey was returning to an institution that had been central to his professional journey for decades.

Spine surgery patient on the golf course

John Toohey, MD (left), a retired UT Health San Antonio orthopaedic surgeon, looks forward to rejoining his son (right) on the golf course in several months once he recovers from his successful spinal stenosis surgery at UT Health San Antonio's Multispecialty and Research Hospital. Toohey was the inaugural surgery patient at the hospital, which opened Dec. 10, 2024.

Today, as Toohey slowly regains his strength and returns to his daily life, he also reflects on the trajectory of his career. He said his work as a surgeon and later as an assistant dean in the Department of Graduate Medical Education at UT Health San Antonio defined him. When the COVID-19 pandemic hit, Toohey decided it was time to retire.

It wasn't an easy decision for someone who admits to being a workaholic.

"I loved my job. I couldn't get enough of it," he said. But the demands of a long career eventually caught up with him. To make his retirement final, Toohey made a bold move: On July 1, 2024, he let his medical license expire. "I forced myself to quit," he said.

From treating others to receiving treatment himself, the experience deepened Toohey's appreciation for the patients he's spent a lifetime serving — and for the skilled hands of those who now stand in his place. It also strengthened his pride in UT Health San Antonio.

"From the minute I walked through the front door of the new hospital right before surgery, I was impressed," he said. "Especially in this era of electronic everything, I was moved by the genuine human interest in me as a patient by everybody I encountered."

After his successful spinal stenosis surgery, Toohey now expects to spend four to six months gradually recovering. He's motivated by what it will allow him to reclaim: his independence and his beloved game of golf.

"My body isn't what it used to be. Of course, it never is at my age," he said with a smile. "Golf is my passion, my addiction. I'm looking forward to playing again."

Sports Medicine

Thomas M. DeBerardino, MD

As a core piece of our Sports Medicine program, the relationship continues to strengthen with the San Antonio Spurs. Dr. Nicolette has completed two years as the head team physician and director of sports medicine. He continues to coordinate the large network of primary and specialty care here to support all the needs of the Spurs; this wouldn't be possible without John Carollo, ATC doing outstanding work cultivating and activating this network to achieve true VIP level service for the entire organization while keeping clinical disruptions low. This relationship with the Spurs has also opened doors with professional soccer as well as with world class performance research, which should be manifesting itself in our portfolios over the next couple of years. But more importantly, these partnerships help set a foundation for working to translate all that we learn and do for professional athletes to increase the health and performance of the community we serve.

And the Spurs might be the most visible, but our other Sports Medicine connections with UTSA, high school sports coverage, and the minor league San Antonio Missions are rounding out the Sports Medicine Division and UT Health San Antonio's support and sports coverage all around our growing city.

We are in our fourth year caring for The University of Texas San Antonio, whose football team continues to excel in the AAC. UTSA made its fifth straight and sixth overall bowl appearance when it faced Coastal Carolina in the Myrtle Beach Bowl on Monday, December 23. The game wase played at Brooks Stadium on the campus of Coastal Carolina University in Conway, South Carolina. The UTSA Roadrunners secured their second straight bowl victory with a 44-15 score. Drs. Jacobs, Heath and Kenneth-Nwosa supported the team heading into and through game day.

Dr. DeBerardino is in his third year as the Sports Medicine Division Chief and is the Head Team Orthopaedic Surgeon for UTSA Athletics and helps cover the Spurs now as well. The division continues to be staffed by Dr. Thomas DeBerardino, Dr. Philip Jacobs, Dr. David Heath, and Dr. Kenneth Kenneth-Nwosa. Dr. DeBerardino continues his passion to teach both nationally and internationally with a recent trip through Salzburg and Munich sharing innovative knee and joint restoration surgical techniques with European surgeons.

Dr. Kenneth-Nwosa continues to serve as Head Team Physician at UTSA. Dr. Kenneth-Nwosa was appointed to American Athletic Conference Medical Advisory Committee

for two-year term.

Dr. Jacobs is in his 20th year as Orthopedic Surgeon for Taft High School and regularly oversees the Houston Open, a PGA Tour Event. He has also served as one of the Team Physicians for the UTSA Roadrunners.

Dr. Heath completed his first year as our newest faculty member of the Sports Medicine Division. He served as one of the Team Physicians for the UTSA Roadrunners and Brandeis High School this past year. Passionate about teaching, he joined the speaking faculty at the medical school and also plays an active role in training the residents in Sports Medicine. We are excited as his practice continues to grow.

Michelle Aguirre continues to care for the Soccer Central community and has shown great determination to expand our footprint on local sidelines. She has been working with their Player Performance Staff to help create a cohesive model of performance and medical working together to better tend to the soccer athlete at Soccer Central. This past year we have been working on creating models to support elite youth athletes for the addition of MLS Next and the Development Player League; as well as a professional model to support the Athenians, our semi-professional women's team, who enters the highly competitive USL W this summer. She has also been working hard together to help design the new sport medicine/performance building at Soccer Central to provide the most current and innovative experience in an athlete's experience in recovery, training preparation and rehabilitation from injury.

Marie Charpentier, PT/ATC, continues to serve as the Director of Rehabilitation at UTSA. Marie leads our CAATE Accredited residency for ATCs pursuing additional education in rehab techniques for the past 3 years with continued success. This program has grown from 2 to 4 residents. She is also a certified yoga instructor and teaches yoga classes for our athletes to assist with recovery and resilience. She is passionate about incorporating mind and body medicine into sports medicine.

Brian Benitez continues as the Head Football AT and Sam Hinojosa serves as the Associate Football AT. Under the leadership of Brian Benitez, the growing team of ATs continues to work tirelessly to supervise medical care at UTSA and continue to provide world-class ATC services to all our UTSA student athletes.

The Department is also grateful to our other subspecialty providers across UT Health San Antonio who keep our athletes healthy.

Summer Rolin, PSYD, and Sports Psychologist, currently appointed in the Rehab Med Department has also received a cross-appointment to Orthopaedics. She continues to work with UTSA and provides neuropsychological evaluation, concussion evaluation, and consultation with medical providers, trainers, and coaches.

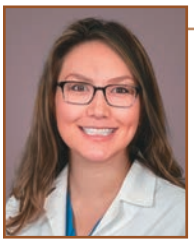
Drs DeBerardino, DeLee, and Nicolette hosted the 52nd Annual UT Health San Antonio Sports Medicine Symposium with the support of many of our UT Health San Antonio Orthopaedic Faculty. This year marked another high point with the most health care providers in attendance for the two-day meeting.

The residents continue their educational sports medicine enrichment at multiple timepoints throughout their five years. The interns spend time with Dr. Jacobs. The second- and fourth-year residents now spend time with Dr. DeBerardino and Dr. Heath performing surgery and seeing clinic. This program continues to grow as we look forward to expanding our sideline coverage of local high school sports this next academic year.

Our Sports Medicine Team also provided UT Health San Antonio's third summer school-required physicals with no cost to families providing exams to over 200 athletes.

One of our recently graduated residents has now completed his Sports Medicine Fellowship. Dr. Adam McNulty attended the Steadman Hawkins Clinic of the Carolinas and is set to return this September to help as faculty with our growing Sports Medicine Division.

Finally, we are delighted to welcome Dr. Leah Brown to our expanding Sports Division. Dr. Brown will be our Head Team Orthopaedic Physician caring for the San Antonio Spurs. Dr. Brown comes to us from Phoenix, AZ, where she served as the Head Team Orthopaedic Physician for the WNBA Mercury after an early career as an Orthopaedic Surgeon in the Navy. She specializes in managing athletes with expertise in knee, elbow and shoulder arthroscopy, and shoulder replacement. Her addition brings a diverse range of skills and experience to our group.



Veterans Administration Division of Orthopaedic Surgery

Christina Brady, MD

The VA orthopedic rotation continues to provide a robust and multidisciplinary training experience for our orthopaedic residents, working alongside PM&R and family medicine residents. This year has brought significant expansions, broadening both clinical services and educational opportunities. Notably, orthopaedic services have extended to the New Braunfels VA Clinic, increasing access to musculoskeletal care for veterans in the region. Additionally, the opening of the Orthopedic Integrated Practice Unit has doubled the footprint of the VA orthopaedic clinic, enhancing efficiency and patient care by integrating on-site physical and occupational therapy.

Our orthopaedic team has also expanded. Full-time providers include Christina Brady, MD (hand surgery), and Zachary Garza, MD, (spine surgery). Several part-time providers have joined our efforts, including Brandon Stein, MD (hand surgery), Shumaila Sarfani, MD (foot and ankle surgery), and Joseph Alderete, MD (orthopaedic

oncology), who remains affiliated with UT. Our established staff continues to provide specialized care, with Siraj Sayeed, MD (total joint reconstruction), John Hinchey, MD (shoulder and elbow), David Roberts MD (general orthopaedic surgery) and Dmitry Tuder MD (hand surgery). We are also excited to welcome Matt Glazier, DO, who will be joining as a shoulder and elbow surgeon after completing his fellowship.

Academically, the VA remains committed to resident education, continuing our weekly multidisciplinary indications conference, regular lectures, and the addition of a monthly skills and anatomy lab, developed in collaboration with UT. The VA is proud to serve the expanding veteran population in South Texas and remains dedicated to instilling the values of service and excellence in the next generation of orthopaedic surgeons.

Our residents play a crucial role in improving the VA rotation, providing frontline patient care in both the clinic and OR, while also engaging in multiple quality improvement projects. Their efforts have helped integrate patient-reported outcome measures, streamline workflows to reduce unnecessary paperwork and visits, and improve access to non-formulary medications. Additionally, they have been instrumental in establishing a food insecurity screening program, which automatically flags veterans in need and initiates social work referrals before their clinical visits. This initiative revealed that 28% of our veterans required social services, highlighting a critical area for continued support and advocacy.

(Left to right) John Hinchey MD, Matt Glazier MD, Zach Garza MD, Joseph Alderete MD, Christina Brady MD, Dmitry Tuder, MD, Brandon Stein MD, Shumaila Sarfani MD.

We remain grateful for our residents' dedication and look forward to further strengthening this program as we continue to serve those who have served us.

04

Research Updates

Research Division

Boris A. Zelle, MD, MBA, Vice-Chair of Research

It has been a great honor and a true privilege to serve on our department as Vice-Chair of Research for the last eight years. As my tenure at UT Health San Antonio is coming to an end this year, I am humbly reflecting on my time at this institution. After completing my orthopaedic trauma fellowship at the University of Pittsburgh Medical Center (UPMC), I joined the faculty at UT Health San Antonio in 2011. At that time, I would have never imagined how extensive and eventful this chapter of my career would become.

When I started a research program at UT Health in 2011, I was inspired by my long-term friend and mentor, Mohit Bhandari from McMaster University, to pursue the study of healthcare disparities in orthopaedics. I felt very intrigued by this idea as I realized that my practice at our county hospital in San Antonio provided an ideal environment for this line of research. As we pursued our investigations, we became very productive, published numerous related papers, presented at meetings, lectured at other universities, and received external funding from various sources. As of today, I remain excited about studying nutritional disparities and developing programs to address malnutrition in our patients and within the San Antonio community. Over the years, our work also received widespread appreciation within the national orthopaedic community. As such, our research was recognized with the 2022 Orthopaedic Trauma Association (OTA) DEI and Health Disparities Research Award, which honored our significant contributions to addressing disparities within orthopaedic trauma care. Moreover, a true highlight and one of the most meaningful moments in my career was receiving the 2024 American Academy of Orthopaedic Surgeons (AAOS) Diversity Award as it honored our sustained efforts and many years of dedicated research in this important field.

As I am moving on to the next chapter of my life, I am looking at a research division within the orthopaedic department that has substantially grown over the years. We have established successful collaborations with the Barshop Institute, Human Performance Institute (HPI), UT Austin, AAOS American Joint Replacement Registry (AJRR), Major Extremity Trauma Research Consortium (METRC), and many other collaborators within our institution and across the globe. Besides the orthopaedic research efforts, our Division of Podiatry has continued to rapidly expand their research program and has recruited several high-profile researchers in this field.

Finally, I wish to convey my sincere gratitude and profound respect to the many research staff, students, residents, fellows, faculty, and collaborators who have contributed to our work over the years. Though they are too numerous to name individually, each has played a valuable role and left a lasting impact on our research. Along this journey, it has been truly rewarding to build lasting relationships with so many exceptional individuals who have enriched not only our research, but also my personal life.

Sincerely,

Boris A. Zelle, MD, MBA, FAAOS, FAOA
Vice-Chair of Research

Food Insecurity Project

Blaire Peterson, Benjamin Fitch, Christina Brady, MD

This year, Dr. Brady and two medical students, Blaire Peterson and Benjamin Fitch, began working on a project regarding food insecurity with Dr. Saucedo, an orthopaedic surgeon in Houston. Inspired by Dr. Zelle's previous work on the matter, this project aims to investigate the prevalence and impact of food insecurity among patients experiencing orthopaedic upper extremity trauma, with a specific focus on regional demographics and social determinants of health (SDOH) in South Texas. The arm of the study here in San Antonio focuses on the veteran population at the Audie L. Murphy VA, while in Houston, the study includes a broader population of all local orthopaedic patients.

Building on the established association between food insecurity and adverse health outcomes, the study intends to explore how food insecurity correlates with depression, anxiety, and frailty in this patient population. In examining these associations, the group seeks to provide insight into the multifaceted risks posed by food insecurity, including its potential contributions to poor surgical outcomes and recovery.

In addition to the research findings, this project has given the team of investigators at the VA the privilege of using the screening process as a quality improvement project to directly provide aid for the patients facing food insecurity, depression, and frailty. With the help of Dr. Brady's staff and frailty clinic at the VA, patients have been connected with community and healthcare resources tailored to address their needs. This has further evolved as Dr. Brady implemented routine screening for food insecurity as a standard procedure for all patients visiting the orthopaedic clinic at Audie L. Murphy VA orthopaedics clinic. The new system connects the patient reported outcome metrics (PROMs) directly to a secure national VA database as well as feeds the information (with interpretation) directly into the patient's chart in CPRS. This provides the treating with a more detailed picture of their patients' needs and allows for implementation of necessary interventions. These efforts not only enhance the care provided to individual patients but also serve as a model for addressing broader healthcare disparities. Through this approach, the team aims to both contribute to the academic understanding of these issues and create meaningful, positive change at the local level.

Basic Science Division – A Year in Review

Vaida Glatt, PhD, Director of Basic Science Research

As the Director of Basic Science Research for the Department of Orthopaedic Surgery at the University of Texas Health Science Center San Antonio and the Dr. Robert and Dr. Louise Hutchinson Endowed Chair for Basic Research in Orthopaedic Surgery, I am excited to share the latest advancements and achievements from our research division over the past year. The Glatt Lab remains deeply committed to pioneering scientific investigations at the intersection of bioengineering and regenerative medicine, with the goal of developing innovative therapies for bone and muscle repair. Our diverse team includes international scholars, clinicians, research assistants, and medical students, all contributing to cutting-edge research that drives progress in orthopaedic science.

For the past eight years, my lab has been developing the Biomimetic Hematoma (BH): A Novel Autologous Scaffold for Growth Factor Delivery to Enhance Bone Healing. Preclinical studies in small and large animal models have demonstrated that BH is the first autologous scaffold capable of efficiently delivering significantly lower doses of rhBMP-2 while effectively initiating the natural bone repair cascade. This approach has successfully repaired large bone defects with much lower rhBMP-2 doses in animal models. In 2023, we published two studies in preclinical small animal models, and our large animal study has been submitted to the Journal of Bone and Joint Surgery. Revisions are currently underway, and the study should be available online in the coming months. Over the past two years, we have conducted clinical studies with approximately 100 patients, including cases of nonunions, delayed unions, large bone defects, and ankle fusions to evaluate BH's safety and efficacy. This work has been conducted in collaboration with Dr. Stephen Quinnan (Paley Institute, FL), Dr. Kevin Tetsworth (Royal Brisbane Hospital, Australia), Dr. Max P. Michalski, Dr. Charles N. Moon, and Dr. Geoffrey Marecek (Cedars Sinai, CA), as well as Dr. Animesh Agarwal and Dr. Joseph Alderete (UT Health San Antonio). Preliminary clinical data suggest that BH is the only clinically tested scaffold capable of delivering ~70% lower doses of rhBMP-2 while still achieving rapid and robust bone regeneration. Notably, its use has not been associated with intraoperative complications, local inflammatory reactions, or wound issues. I have filed two international patents related to this bone regeneration technology, and in 2023, I founded VitaBone Medical Inc. to bring BH to market. We are currently advancing through the FDA approval process and actively fundraising to support commercialization.

Building on our work in bone regeneration, we explored the potential of a Biomimetic Hematoma (BH) scaffold for volumetric muscle loss (VML) repair, recognizing the critical role of hematoma in both muscle and bone healing. Preliminary data suggest that BH effectively regenerates large muscle defects that would otherwise not heal, with treated muscles integrating seamlessly into native tissue, resembling the uninjured limb. This breakthrough holds promise not only for traumatic injury treatment but also for accelerating recovery in professional athletes. To protect this innovation, a provisional patent was filed on February 1, 2024. Additionally, I was recently awarded a Trauma Research and Combat Casualty Care Collaborative (TRC4/DoD) grant ($500,000; 2024–2026) to further investigate muscle regeneration using BH and Rspo-2 mRNA.

The Basic Science Research Division continues to foster global collaborations in musculoskeletal research, engaging with partners across multiple continents. This year, we are excited to welcome Dr. Fabio Rodrigues, an orthopedic surgeon from Brazil, who will join us as a research fellow for eight months to establish research initiatives and plan clinical studies

Continued on page 28 ►

► *Continued from page 27*

in Brazil utilizing my Reverse Dynamization technology. Additionally, we maintain active collaborations with Dr. Mikhail Samchukov and Dr. Alexander Cherkashin (Texas Scottish Rite Hospital for Children, Dallas, TX) and Dr. Christopher Iobst (Nationwide Children's Hospital, Columbus, OH) on projects exploring the clinical applications of Reverse Dynamization, a method I developed to enhance bone regeneration. Our research team also continues working with Dr. Kevin Tetsworth (Australia), a leading expert in limb salvage and reconstruction, to investigate the biologic properties of Masquelet membranes and their potential role in facilitating the repair of large bone defects.

I continue to hold an adjunct appointment at the Sam and Ann Barshop Institute for Longevity and Aging Studies, where my research focuses on combating chemotherapy-induced bone loss. My ongoing project, Targeting Senescent Cells to Prevent Chemotherapy-Induced Bone Loss, explores a novel approach using senolytic drugs to enhance the regenerative capacity of aging bone and reverse bone deterioration caused by chemotherapy. Our findings indicate that senolytic drugs effectively prevent and even reverse chemotherapy-induced bone loss in both male and female mice, highlighting their potential as a therapeutic strategy for preserving bone health in cancer patients.

Over the past year, the Glatt Lab has published five peer-reviewed articles in orthopaedic literature and presented research at various national and international conferences. I was honored to speak at RegenMed-SA in San Antonio, McGill University in Montreal, Cedars Sinai in Los Angeles, and grand rounds at Grady Hospital in Atlanta, among others, discussing our latest advancements in bone and muscle regeneration. Additionally, our research division continues to mentor medical students and residents at UT Health San Antonio, offering hands-on experience in clinical study design and manuscript preparation.

Podiatry Research

Cyaandi R. Dove, DPM

Under the leadership of Dr. Cyaandi Dove and Dr. Lawrence Lavery, the Division of Podiatry continues to lead in clinical research and academic excellence. Dr. Dove brings expertise in complex studies and mentorship, while Dr. Lavery is renowned for his work in diabetic foot care.

Education and mentorship are central to the division's mission. Residents have actively contributed to research this year, submitting numerous abstracts and posters accepted at national conferences.

Jhemima Rizalde

Key collaborations include:

- A wound registry project with Dr. Zelle's Orthopaedics team and Solventum.
- A study with University Health Institute for Public Health analyzing disparities in atraumatic lower extremity amputations from 2022–2024.
- A randomized trial with the Sports Medicine team on Glyceryl Trinitrate Patch therapy for chronic Achilles tendinopathy.
- A joint study with Dr. Brandon Brooks (VA South Carolina) on depression as a social contagion in patients with chronic conditions.

Ongoing trials address major podiatric issues:

- **BioStem**: Evaluating BR-AM for non-healing diabetic foot ulcers.
- **Mediwound:** Testing EscharEx for venous leg ulcer debridement.
- **Snapshot:** Using NIRS to assess PAD severity.
- **BBGFM:** Observational study on treatment for diabetic foot ulcers with osteomyelitis.

The division also contributes to:

- **Kerecis registry:** Collecting real-world data on wound treatment.
- **Diabetic Foot Consortium (DFC):** NIH-supported, studying DFUs to improve healing and reduce amputations via biomarker research.

A key member of the team, **Jhemima Rizalde**, has made invaluable contributions to the division's research success. She has played a vital role in drafting study protocols, ensuring research stays on track, and bringing teams together to keep momentum strong. Her ability to maintain cordial and collegial relationships with collaborators has helped foster a positive and productive research environment, making her a cornerstone of many ongoing efforts.

With strong leadership, collaborative momentum, and dedicated team members like Ms. Rizalde, the division continues advancing podiatric research, care, and education.

Residents and Medical Students Research Highlights

By Blaire Peterson, MS3 and Benjamin Fitch, MS2, Student Editors

Research is a vital component of medical training. Along with enhancing clinical understanding and contributing to advancements in patient care, research allows medical students and residents to investigate their own interests and grow comfortable discussing challenging topics. Over the past year, numerous orthopaedic conferences have provided opportunities for these medical trainees to showcase their projects. This article highlights some examples of the exceptional work presented by medical students and residents at various conferences.

Mid-America Orthopaedic Association / April 10-14, 2024

Fellow fourth-year medical students, Travis Kotzur and Aaron Singh, attended the Mid-America Orthopedic Association conference in Bonita Springs, Florida. Travis presented his work with Dr. Buttacavoli on the impact of disease-modifying anti-rheumatic drug (DMARD) use on total knee arthroplasty outcomes; they found an increased risk of postoperative infection and revision surgery in patients taking DMARDs. Aaron presented his work with Dr. Brady on factors impacting hospital charges of rotator cuff repair; this is a topic of increasing interest since the passing of the Health Care PRICE Transparency Act in 2021.

Orthopaedic Summit / September 14-18, 2024

Fellow third-year medical students, Lindsey Peng and Blaire Peterson, attended Orthopaedic Summit in Las Vegas, Nevada to present their respective projects. Blaire Peterson worked with Dr. Martin to investigate the impact of diabetic neuropathy on trimalleolar fracture outcomes; they found that patients with diabetic neuropathy had higher odds of postoperative complications than non-diabetic patients and diabetic patients without neuropathy. Lindsey worked with Dr. Brady to explore factors impacting hospital charges for anterior cruciate ligament reconstruction. They found that factors such as hospital ownership, size of hospital, and mortality had the greatest impact on increased hospital list price.

American Society for Surgery of the Hand / September 19-21, 2024

Kellie Hastings, a fourth-year medical student, attended ASSH in Minneapolis, Minnesota to present her research, "Internal Joint Stabilizer for Chronic Elbow Dislocation: A Surgical Technique Video." Alongside Dr. Dutta, Kellie created a video demonstrating the insertion technique for Internal Joint Stabilizer devices, which show promising outcomes in restoring stable joints and recovering range of motion, particularly in challenging patients.

Orthopaedic Trauma Association / October 23-26, 2024

Luke Verlinksy, a PGY-3, and Loc-Uyen Vo, a PGY-5, presented at OTA in Montreal, Canada; their project was titled "Health Disparities in Patients with Musculoskeletal Injuries: Food Insecurity Is a Common and Clinically Challenging Problem." Working with Dr. Zelle, they sought to determine the incidence of food insecurity in an orthopaedic trauma clinic, as well as the demographics and clinical factors associated with food insecurity. Additionally, they investigated any differences in postoperative complications amongst the patient population; they found that food insecure patients were associated with a higher percentage of superficial infections.

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ADULT RECONSTRUCTION

The Effect of Depression on Total Knee Arthroplasty

Kotzur, T., Singh, A., Peng, L., Lundquist, K., Peterson, B., Young, W., **Buttacavoli, F.**, & **Moore, C.**

Introduction: Depression is among the most common mental illnesses, with an estimated 8.1% of adults in the United States living with the condition. Despite its prevalence, the effect of depression on surgical outcomes is not well studied. The aim of this study is to assess the effect of diagnosed major depressive disorder on postoperative outcomes following total knee arthroplasty (TKA).

Methods: This retrospective cohort study used the National Readmissions Database from 2016 to 2019 to evaluate the effect of depression on 30-day outcomes following TKA. Patients with and without a diagnosis of depression were identified using International Classification of Diseases, 10th Revision, Clinical Modification/Procedure Coding System (ICD-10) codes. Propensity score matching was employed to balance patient demographics, socioeconomic status, and comorbidities, between the two groups. Multivariate regression analyses were used to assess postoperative outcomes, 30-day readmission, and revision surgery rates.

Results: Overall, 1,906,980 patients undergoing TKA, 302,853 (15.68%) with a diagnosis of depression, were included in our analysis. After matching, those with depression were more likely to have both medical (odds ratio [OR] 1.90; $P < 0.001$) and surgical complications (OR 1.86; $P < 0.001$), including periprosthetic fracture (OR 2.27; $P < 0.001$). In addition, they had increased odds of 30-day readmission (OR 1.98; $P < 0.001$) and revision surgery (OR 1.83; $P < 0.001$).

Conclusion: Depression is common in the TKA population, with 15.9% of patients having a diagnosis at the time of surgery. Furthermore, these patients experience a greater risk of complications following surgery. They are also at greater risk of requiring readmission or revision surgery. Overall, patients with depression may experience worse outcomes following TKA.

The Impact of Cardiac Arrhythmias on Total Knee Arthroplasty Outcomes

Kotzur, T., Singh, A., Lundquist, K., Dickinson, J., Peterson, B., **Buttacavoli, F.**, & **Moore, C.**

Background: Cardiac comorbidities are common in patients undergoing total knee arthroplasty (TKA). While there is an abundance of research showing an association between cardiac abnormalities and poor postoperative outcomes, relatively little is published on specific pathologies. The aim of this study was to assess the impact of cardiac arrhythmias on postoperative outcomes in the setting of TKA.

Methods: This retrospective cohort study included all patients undergoing TKA from a national database, from 2016 to 2019. Patients who had cardiac arrhythmias were identified via International Classification of Diseases, Tenth Revision, and Clinical Modification/Procedure Coding System codes and served as the cohort of interest. Multivariate regression was performed to compare postoperative outcomes. Gamma regression was performed to assess length of stay and total charges, while negative binomial regression was used to assess 30-day readmission and reoperation. Patient demographic variables and comorbidities, measured via the Elixhauser comorbidity index, were controlled in our regression analysis. Out of a total of 1,906,670 patients, 224,434 (11.76%) had a diagnosed arrhythmia and were included in our analyses.

Results: Those who had arrhythmias had greater odds of both medical (odds ratio [OR] 1.52; $P < .001$)

and surgical complications (OR 2.27; P < .001). They also had greater readmission (OR 2.49; P < .001) and reoperation (OR 1.93; P < .001) within 30 days, longer hospital stays (OR 1.07; P < .001), and greater total charges (OR 1.02; P < .001).

Conclusions: Cardiac arrhythmia is a common comorbidity in the TKA population and is associated with worse postoperative outcomes. Patients who had arrhythmias had greater odds of both medical and surgical complications requiring readmission or reoperation.

Comparing Common Risk Assessment Tools to Predict Outcomes in Total Knee Arthroplasty

Kotzur, T., Singh, A., Peng, L., Makhani, A., Seifi, A., & **Moore, C.**

Background: A number of tools exist to aid surgeons in risk assessment, including the Charlson Comorbidity Index (CCI), the Elixhauser Comorbidity Index (ECI), and various measures of frailty, such as the Hospital Frailty Risk Score (HFR). While all of these tools have been validated for general use, the best risk assessment tool is still debated. Risk assessment is particularly important in elective surgery, such as total joint arthroplasty. The aim of this study is to compare the predictive power of the CCI, ECI, and HFR in the setting of total knee arthroplasty (TKA).

Methods: All patients who underwent TKA were identified via International Statistical Classification of Diseases and Related Health Problems, Tenth Revision code from the National Readmissions Database, years 2016 to 2019. Patient demographics, perioperative complications, and hospital-associated outcomes were recorded. Receiver operating characteristic (ROC) curves were created and area under the curves (AUCs) evaluated to gauge the predictive capabilities of each risk assessment tool (CCI, ECI, and HFR) across a range of outcomes.

Results: A total of 1,930,803 patients undergoing TKA were included in our analysis. For mortality, ECI was most predictive (0.95 AUC), while HFR and CCI were 0.75 and 0.74 AUC, respectively. For periprosthetic fractures, ECI was 0.78 AUC, HFR was 0.68 AUC, and CCI was 0.66 AUC. For joint infections, the ECI was 0.78 AUC, the HFR was 0.63 AUC, and the CCI was 0.62 AUC. For 30-day readmission, ECI was 0.79 AUC, while HFR and CCI were 0.6 AUC. For 30-day reoperation, ECI was 0.69 AUC, while HFR was 0.58 AUC and CCI was 0.56 AUC.

Conclusions: Our analysis shows that ECI is superior to CCI and HFR for predicting 30-day postoperative outcomes following TKA. Surgeons should consider assessing patients using ECI prior to TKA.

Robot-Assisted Total Hip Arthroplasty is Associated With an Increased Risk of Periprosthetic Fracture

Singh, A., Kotzur, T., Peng, L., Emukah, C., **Buttacavoli, F., & Moore, C.**

Background: Total hip arthroplasty (THA) aims to restore joint function and relieve pain. New technology, such as robot assistance, offers the potential to reduce human error, improve precision, and improve postoperative outcomes. The aim of this study was to compare outcomes between conventional and robot-assisted THA.

Methods: This is a retrospective cohort study utilizing a national database from 2016 to 2019. Patients

undergoing THA, conventional or robot-assisted, were identified via the International Classification of Diseases, Tenth Revision code. Multivariate regressions were performed to assess outcomes between groups. Negative binomial regressions were performed to assess discharge disposition, readmission, and reoperation. Gamma regressions with log-link were used to assess total charges and lengths of hospital stays. Patient demographics and comorbidities, measured via the Elixhauser comorbidity index, were controlled for in our analyses. A total of 1,216,395 patients undergoing THA, 18,417 (1.51%) with robotic assistance, were identified.

Results: Patients undergoing robot-assisted procedures had increased surgical complications (odds ratio [OR] 1.31 [95% confidence interval [CI] 1.14 to 1.53]; P < .001), including periprosthetic fracture (OR 1.63 [95% CI 1.35 to 1.98]; P < .001). Notably, these patients also had significantly greater total charges (OR 1.20 [95% CI 1.11 to 1.30]; P < .001).

Conclusions: Robotic assistance in THA is associated with an increased risk of surgical complications, including periprosthetic fracture, while incurring greater charges.

Aspirin in prevention of venous thromboembolism following hip fracture surgery: A systematic review and meta-analysis

Williamson, T., Martinez, V., Aziz, A., Kotzur, T., Verlinsky, L., & **Buttacavoli, F.**

Background: Many orthopaedic surgeons routinely prescribe aspirin (ASA) as prophylaxis for venous thromboembolism (VTE) following hip fracture surgery (HFS). The purpose of this study is to assess the effectiveness of aspirin to other agents in preventing VTE and mortality following hip fracture surgery.

Methods: Following PRISMA guidelines, we performed a search for HFS studies from 1998 to 2023 reporting comparisons between aspirin and other chemoprophylaxis methods for VTE (DVT - deep vein thrombosis; PE - pulmonary embolism). SPSS Meta-analysis function was used to calculate Mean Effect Size Estimate (MESE) and 95 % Confidence Intervals for each outcome. Reverse Fragility Index (RFI) and Fragility Quotient (FQ) were calculated for each study.

Results: Of the 847 articles screened, 4 studies with 5 comparisons met the search criteria to be included for analysis. A total of 1194 participants were included in these studies. There was a decreased risk of mortality seen with use of aspirin compared to other agents (MESE = 0.86, 95 % CI: [0.07-1.66]; p=.03). There was no increased risk of DVT or PE with use of aspirin (both p>.4). The overall RFI and FQ for all 19 outcomes were 12 (IQR: 6.5-15) and 0.080 (IQR: 0.027-0.110), respectively. Ten studies (52.6 %) reported a loss-to-follow-up (LTF) greater than the overall RFI.

Conclusions: Aspirin demonstrates similar protective effects on prevention of VTE compared to other agents and may have significant protective effects on overall mortality following surgical intervention for hip fractures. However, the current evidence concerning its use in this arena is less than robust, with more than half of the studied outcomes considered statistically fragile.

The Fragility of Statistical Significance in the Use of Aspirin in Prevention of Venous Thromboembolism Events Following Total Joint Arthroplasty: Systematic Review and Meta-Analysis of Randomized Controlled Trials

Williamson, T., Martinez, V., Verlinsky, L., Brennan, J., & **Buttacavoli, F.**

Background/Objectives: Comparative studies often use the p value to convey statistical significance, but fragility indices (FI) and fragility quotients (FQ) may better signify statistical strength. The use of aspirin as venous thromboembolism (VTE) chemoprophylaxis following elective arthroplasty has been debated between the orthopedic and cardiac fields. The purpose of this study was to apply both the FI and FQ to evaluate the degree of statistical fragility in the total joint arthroplasty (TJA) literature regarding aspirin (ASA) use for VTE prevention.

Methods: We performed a systematic search for TJA clinical trials from 2004 to 2023 reporting comparisons between ASA and other chemoprophylaxis methods for VTE. The FI of each outcome was calculated through reversal of a single outcome event until significance was reversed. The FQ was calculated by dividing each fragility index by study sample size and interquartile range (IQR) was calculated. SPSS Meta-analysis function was used to calculate the Mean Effect Size Estimate and 95% Confidence Intervals for each outcome.

Results: Of 245 articles screened, 39 met search criteria, with 10 RCTs included for analysis (n = 11,481 patients). There were 38 outcome events reported, with three significant ($p < 0.05$) outcomes and 35 non-significant ($p > 0.05$) outcomes identified. The overall FI and FQ for all 38 outcomes were 6 (IQR: 5-7) and 0.059 (IQR: 0.044-0.064), respectively. Seven studies (70%) reported a loss-to-follow-up (LTF) greater than the overall FI. There was no increased risk of DVT, PE, or mortality with use of ASA (all $p > 0.2$).

Conclusions: Despite showing non-inferiority in preventing venous thromboembolic events in TJA overall, the highest-level peer-reviewed literature concerning aspirin use following total joint arthroplasty is considered statistically fragile due to high loss-to-follow-up. In addition to the reporting of the p value, the fragility index and quotient can further provide insight into the strength and trustworthiness of outcome measures.

Patient-Level Factors, Outcomes, and Costs Associated With Facility Transfer Following Total Knee Arthroplasty: A Retrospective Database Study

Young, W., Peterson, B., Kotzur, T., Singh, A., **Buttacavoli, F., & Moore, C.**

Background: Patient disposition following total knee arthroplasty (TKA) has major implications for patient outcomes and costs. Current studies are limited in sample size and dates of data collection. We evaluated patient factors, outcomes, and costs associated with disposition to a facility following TKA.

Methods: This was a retrospective cohort study including 1,906,670 patients undergoing TKA from a nationwide database, from the years 2016 to 2020. Of these, 25,485 (1.34%) patients were transferred to a facility for rehabilitation. Demographic data, hospital-related outcomes, and postoperative complications were collected. Multivariate regression was performed to assess outcomes associated with facility transfer for rehabilitation.

Results: Patients were more likely to be transferred if they were women (odds ratio (OR) = 1.10; $P < 0.001$), greater than 80 years (OR = 2.25; $P < 0.001$), had an increased Elixhauser comorbidity index (OR = 1.38; $P < 0.001$), or were in the lowest income quartile (OR = 1.38; $P < 0.001$). Transferred patients were more likely to experience medical (OR = 1.92; $P < 0.001$) and surgical complications (OR = 2.74; $P < 0.001$), including vascular complications (OR = 2.07; $P < 0.001$), neurologic complications (OR = 5.72;

P < 0.001), and dislocation (OR = 2.01; P < 0.001). They also had greater hospital lengths of stay (OR = 5.27; P < 0.001) and hospital charges (OR = 1.88; P < 0.001); however, they were less likely to undergo reoperation within 30 days (OR = 0.61; P = 0.002).

Conclusions: Elderly, lower income patients who had more comorbidities are more likely to be transferred to a facility following TKA. While there are associated increased costs, complications, and hospital lengths of stay, there are lower rates of reoperation for those who transferred to a facility after TKA.

BASIC SCIENCE RESEARCH

Biomechanics of fracture healing: how best to optimize your construct in the OR

Hast, M., **Glatt, V.**, Archdeacon, M., Ledet, E., Lewis, G., Ahn, J., & Haller, J.

Orthopaedic surgeons routinely assess the biomechanical environment of a fracture to create a fixation construct that provides the appropriate amount of stability in efforts to optimize fracture healing. Emerging concepts and technologies including reverse dynamization, "smart plates" that measure construct strain, and FractSim software that models fracture strain represent recent developments in optimizing construct biomechanics to accelerate bone healing and minimize construct failure.

Cadaveric Biomechanical Laboratory Research Can Be Quantitatively Scored fQuality With the Biomechanics Objective Basic Science Quality Assessment Tool: The BOBQAT Score

Hohmann, E., Paschos, N., Keough, N., Erbulut, D., Oberholster, A., **Glatt, V.,** Molepo, M., & Tetsworth, K.

Purpose: To develop a quality appraisal tool for the assessment of cadaveric biomechanical laboratory and other basic science biomechanical studies.

Methods: For item identification and development, a systematic review of the literature was performed. The content validity index (CVI) was used either to include or exclude items. The content validity ratio (CVR) was used to determine content validity. Weighting was performed by each panel member; the final weight was either up- or downgraded to the closest of 5% or 10%. Face validity was scored on a Likert scale ranked from 1 to 7. Test-retest reliability was determined using the Fleiss kappa coefficient. Internal consistency was assessed with Cronbach's alpha. Concurrent criterion validity was assessed against the Quality Appraisal for Cadaveric Studies scale.

Results: The final Biomechanics Objective Basic science Quality Assessment Tool (BOBQAT) score included 15 items and was shown to be valid, reliable, and consistent. Five items had a CVI of 1.0; 10 items had a CVI of 0.875. For weighting, 5 items received a weight of 10%, and 10 items a weight of 5%. CVR was 1.0 for 6 items and 0.75 for 9 items. For face validity, all items achieved a score above 5. For test-retest reliability, almost-perfect test-retest reliability was observed for 10 items, substantial agreement for 4

items, and moderate agreement for 1 item. For internal consistency, Cronbach's alpha was calculated to be 0.71. For concurrent criterion validity, Pearson's product-moment correlation was 0.56 (95% confidence interval [CI] = 0.38-0.70, P = .0001).

Conclusions: Cadaveric biomechanical and laboratory research can be quantitatively scored for quality based on the inclusion of a clear and answerable purpose, demographics, specimen condition, appropriate bone density, reproducible technique, appropriate outcome measures, appropriate loading conditions, appropriate load magnitude, cyclic loading, sample size calculation, proper statistical analysis, results consistent with methods, limitations considered, conclusions based on results, and disclosure of funding and potential conflicts.

Clinical relevance: Study quality assessments are important to evaluate internal and external validity and reliability and to identify methodological flaws and misleading conclusions. The BOBQAT score will help not only in the critical appraisal of cadaveric biomechanical studies but also in guiding the designs of such research endeavors.

HAND AND PLASTIC SURGERY

A Review of 1228 In-Office Hand Surgery Procedures With Wide Awake Local Anesthesia No Tourniquet (WALANT) at a Single Private Practice

Coffman, J., Dela Cruz, J., Stein, B., Bagg, M., Person, D., Desai, K., & Srinivasan, R.

Background: This study examined the complication rate of Wide Awake Local Anesthesia No Tourniquet (WALANT) technique in the clinic setting with field sterility at a single private practice. We hypothesized that WALANT is safe and effective with a low complication rate.

Methods: This retrospective chart review included 1228 patients who underwent in-office WALANT hand procedures at a single private practice between 2015 and 2022. Patients were divided into groups based on type of procedure: carpal tunnel release, A1 pulley release, first dorsal compartment release, extensor tendon repair, mass excision, foreign body removal, and needle aponeurotomy. Patient demographics and complications were recorded; statistical comparisons of cohort demographics and risk factors for complications were completed, and $P < .05$ was considered significant for all statistical comparisons.

Results: The overall complication rate for all procedures was 2.77% for 1228 patients including A1 pulley release (n = 962, 2.7%), mass excision (n = 137, 3.7%), extensor tendon repair (n = 23, 4.3%), and first dorsal compartment release (n = 22, 8.3%). Carpal tunnel release, foreign body removal, and needle aponeurotomy groups experienced no complications. No adverse events (e.g. vasovagal reactions, digital ischemia, local anesthetic toxicity, inadequate vasoconstriction) were observed in any group. Patients with known autoimmune disorders and those who were currently smoking had a statistically significant higher complication rate.

Conclusions: Office-based WALANT procedures with field sterility are safe and effective for treating common hand maladies and have a similar complication profile when compared to historical controls from the standard operating room in an ambulatory center or hospital.

Revisiting Amputation Rates in High-Pressure Injection Injuries

Jakkaraju, S., **Sager, B.**, & **Brady, C.**

Purpose: High-pressure injection injuries are a rare, and potentially serious, trauma that has historically been associated with high-amputation rates. This study aimed to assess the amputation rates, materials involved, and outcomes at a single institution.

Methods: A retrospective analysis of 53 cases at a level-1 trauma center in South Central Texas between 2007 and 2023 was conducted. Patient demographics, injury details, materials injected, surgical interventions, complications, and follow-up data were collected and analyzed.

Results: There was an amputation rate of 2.2. Latex-based paints showed more favorable outcomes when compared with grease injections and oil-based paints. There were also fewer reoperations and postoperative complications with latex-based paint injuries.

Conclusions: The study signals the need for a re-evaluation of high-pressure injection injury outcomes, highlighting a more optimistic prognosis than previously thought. The evolution of materials in paints, especially latex-based paints, may have been associated with a lower rate of amputation than what was previously reported.

Upper Extremity Stress Fractures

Koslosky, E. J., **Heath, D. M**., Atkison, C. L., **Dutta, A., & Brady, C. I**.

Background: Stress injuries are often missed secondary to their insidious onset, milder symptoms, and subtle or initially absent findings when imaged.

Main body: This review aims to provide strategies for evaluating and treating upper extremity stress fractures. This article outlines the classic presentation of each fracture, the ages during which these injuries often occur, the relevant anatomy and biomechanics, and the mechanism of each injury. Diagnostic imaging and management principles are also discussed, including the use of conservative versus surgical management techniques.

Short conclusion: Upper extremity stress fractures are often mild injuries that resolve with conservative management but can lead to more serious consequences if ignored. Given their increasing incidence, familiarity with diagnosis and management of these injuries is becoming increasingly pertinent.

Evaluation of a Large Language Model's Ability to Assist in an Orthopedic Hand Clinic

Kotzur, T., Singh, A., Parker, J., Peterson, B., **Sager, B., Rose, R., Corley, F., & Brady, C.**

Background: Advancements in artificial intelligence technology, such as OpenAI's large language model, ChatGPT, could transform medicine through applications in a clinical setting. This study aimed to assess the utility of ChatGPT as a clinical assistant in an orthopedic hand clinic.

Methods: Nine clinical vignettes, describing various common and uncommon hand pathologies, were

constructed and reviewed by 4 fellowship-trained orthopedic hand surgeons and an orthopedic resident. ChatGPT was given these vignettes and asked to generate a differential diagnosis, potential workup plan, and provide treatment options for its top differential. Responses were graded for accuracy and the overall utility scored on a 5-point Likert scale.

Results: The diagnostic accuracy of ChatGPT was 7 out of 9 cases, indicating an overall accuracy rate of 78%. ChatGPT was less reliable with more complex pathologies and failed to identify an intentionally incorrect presentation. ChatGPT received a score of 3.8 ± 1.4 for correct diagnosis, 3.4 ± 1.4 for helpfulness in guiding patient management, 4.1 ± 1.0 for appropriate workup for the actual diagnosis, 4.3 ± 0.8 for an appropriate recommended treatment plan for the diagnosis, and 4.4 ± 0.8 for the helpfulness of treatment options in managing patients.

Conclusion: ChatGPT was successful in diagnosing most of the conditions; however, the overall utility of its advice was variable. While it performed well in recommending treatments, it faced difficulties in providing appropriate diagnoses for uncommon pathologies. In addition, it failed to identify an obvious error in presenting pathology.

Risk Factors for Leaving Against Medical Advice in Patients Admitted for Upper Extremity Orthopedic Procedures

Momtaz, D., Ghilzai, U., Okpara, S., Ghali, A., Gonuguntla, R., Kotzur, T., Zhu, K., Seifi, A., & **Rose, R.**

Introduction: Patients who leave against medical advice (AMA) face increased risks of negative health outcomes, presenting a challenge for healthcare systems. This study examines demographic and hospital course factors associated with patients leaving AMA after an upper extremity (UE) orthopaedic procedure.

Methods: We analyzed 262,912 patients who underwent UE orthopaedic procedures between 2011 and 2020, using the Healthcare Cost and Utilization Project database. We then compared demographic and hospital course factors between patients who left AMA and those who did not leave AMA.

Results: Of 262,912 UE orthopaedic patients, 0.45% (1,173) left AMA. Those more likely to leave AMA were aged 30 to 49 (OR, 5.953, $P < 0.001$), Black (OR, 1.708, $P < 0.001$), had Medicaid (OR, 3.436, $P < 0.001$), and were in the 1st to 25th income percentile (OR, 1.657, $P < 0.001$). Female patients were less likely to leave AMA than male patients (OR, 0.647, $P < 0.001$). Patients leaving AMA had longer stays (3.626 versus 2.363 days, $P < 0.001$) and longer recovery times (2.733 versus 1.977, $P < 0.001$).

Conclusion: We found that male, Black, younger than 49 years old, Medicaid-insured, and lowest income quartile patients are more likely to leave AMA after UE orthopaedic treatment.

Socioeconomic status affects amputation and mortality rates in necrotizing fasciitis patients

Momtaz, D., **Heath, D.**, Ghali, A., Krishnakumar, H., Schultz, R., Gonuguntla, R., & **Brady, C.**

Purpose: Necrotizing fasciitis (NF) is a rare, but rapidly progressing bacterial infection of the subcutaneous tissues and muscular fascia with high rates of morbidity and mortality. Our study aims to determine if socioeconomic status (SES) is a predictor of outcomes in NF.

Methods: A retrospective review was conducted of patients diagnosed with NF at our institution. Demo-

graphic information, insurance status, medical and surgical history, vitals, ASA score, blood laboratory values, surgical procedure information, and outcomes prior to patient discharge were collected. Patient zip codes were utilized to obtain median household incomes at the time of the patient's surgical procedure to determine SES. Patients without complete data in their medical record were excluded. Initial descriptive statistics and logistic regression models were performed.

Results: We identified 196 patients (mean age 50.13 ± 13.03 years, 31.6% female) for inclusion. Mortality rate was 15.3% (n = 30) and 33.7% (n = 66) underwent amputation. Mortality rate was not significantly different across income brackets. Lower income brackets had higher rates of amputation than higher income brackets ($p < 0.05$). A logistic regression models showed the rate of amputation decreases by 29% for every $10,000 increment in median household income and ASA score decreased by 0.15 units for every $10,000 increase in median household income.

Conclusions: Amputation rates in cases of NF are significantly higher in lower SES groups than higher SES groups. Patients with perivascular disease in lower SES groups were more likely to experience serious complications of NF than their counterparts in higher SES groups.

Physeal Closure and Fracture Pattern in Adolescent Transitional Distal Radius Fractures

Strauss, G., Brennan, J., Momtaz, D., Ghali, A., Landrum, M., & **Rose, R.**

Purpose: To show a correlation between grade of physeal closure and fracture pattern in adolescent transitional distal radius fractures.

Methods: A retrospective chart review was performed of 490 distal radius fractures, ages 14 to 18, at a single institution between 2007 and 2020. A board-certified orthopaedic hand surgeon reviewed all images. Thirty-six distal-radius fractures were considered adolescent transitional fractures. The review included Salter-Harris classification, fracture fragments, and grade of physeal closure.

Results: Distal radial physeal closure is 50 times more likely to be of a higher grade in the presence of Salter-Harris type IV fractures ($P < 0.001$). Closure of the physis is also 7.37 and 13.08 times more likely to be of higher grade in the absence of a dorsal metaphyseal fracture and in the presence of an ulnar corner fracture, respectively ($P = 0.011$ and 0.021).

Conclusion: Adolescent transitional fractures of the distal radius occur when the growth plate has a partial closure. The closure pattern of the distal radial physis begins centrally, with subsequent ulnar and then radial closure. In this cohort, there is a correlation between grade of physeal closure and fracture pattern in adolescent transitional distal radius fractures.

ORTHOPEDIC ONCOLOGY

Wilderness Medical Societ Clinical Practice Guidelines for Spinal Cord Protection: 2024 Update

Hawkins, S., Williams, J., Bennett, B., Islas, A., & **Quinn, R.**

The Wilderness Medical Society reconvened an expert panel to update best practice guidelines for spinal cord protection during trauma management. This panel, with membership updated in 2023, was charged with the development of evidence-based guidelines for management of the injured or potentially injured spine in wilderness environments. Recommendations are made regarding several parameters related to spinal cord protection. These recommendations are graded based on the quality of supporting evidence and balance the benefits and risks/burdens for each parameter according to American College of Chest Physicians methodology. Key recommendations include the concept that interventions should be goal-oriented (spinal cord/column protection in the context of overall patient and provider safety) rather than technique-oriented (immobilization). An evidence-based, goal-oriented approach excludes the immobilization of suspected spinal injuries via rigid collars or backboards.

Traumatic Transradial Forearm Amputation Temporized With Extracorporeal Membrane Oxygenation: A Brief Report

Hegeman, E., Fisher, M., Cognetti, D., Plucknette, B., **Alderete, J.,** Wilson, D., & Causey, M.

Introduction: Extracorporeal membrane oxygenation (ECMO) is typically used to provide mechanical perfusion and gas exchange to critically ill patients with cardiopulmonary failure. We present a case of a traumatic high transradial amputation in which the amputated limb was placed on ECMO to allow for limb perfusion during bony fixation and preparations and coordination of orthopedic and vascular soft tissue reconstructions.

Materials and methods: This is a descriptive single case report which underwent management at a level 1 trauma center. Institutional review board (IRB) approval was obtained.

Results: This case highlights many important factors of limb salvage. First, complex limb salvage requires a well-organized, pre-planned multi-disciplinary approach to optimize patient outcomes. Second, advancements in trauma resuscitation and reconstructive techniques over the past 20 years have drastically expanded the ability of treating surgeons to preserve limbs that would have otherwise been indicated for amputation. Lastly, which will be the focus of further discussion, ECMO and EP have a role in the limb salvage algorithm to extend current timing limitations for ischemia, allow for multidisciplinary planning, and prevent reperfusion injury with increasing literature to support its use.

Conclusions: ECMO is an emerging technology that may have clinical utility for traumatic amputations, limb salvage, and free flap cases. In particular, it may extend current limitations of ischemia time and reduce the incidence of ischemia reperfusion injury in proximal amputation, thus expanding the current indications for proximal limb replantation. It is clear that developing a multi-disciplinary limb salvage team with standardized treatment protocols is paramount to optimize patient outcomes and allows limb salvage to be pursued in increasingly complex cases.

Identifying Improvements in Treating Extremity Musculoskeletal Injuries During Prolonged Care

Johnson, W., Perry, A., Flores, G., Pierrie, S., **Alderete, J.**, Jr., Allen, P., Wilson, J., King, D., Childers, W., & Tactical Medical Advisory, P.

Introduction: In prolonged care scenarios, where medical evacuations are significantly delayed, the treat-

ment and transport of casualties with extremity musculoskeletal injuries will drain combat units' human resources. Developing enhanced splinting techniques to restore casualty mobility and function can alleviate this drain. To guide this development, a panel of tactical combat and wilderness medicine experts was assembled to determine which extremity musculoskeletal injuries had the greatest impact on unit capabilities, and the materials available for splinting these injuries.

Information gathering: Unstructured consultations with panel members yielded preliminary lists of injuries and materials. These lists were consolidated and redistributed to panel members for final evaluation where they ranked the injuries based on frequency and human resource cost and assessed the accessibility of materials. Responses for the final evaluation were statistically analyzed using Wilcoxon rank-sum tests and Placket Luce models.

Lessons learned: Aggregated responses indicated that panel members thought that knee and ankle ligamentous injuries and radial head fractures were the most frequently occurring injuries, although closed distal femoral fractures, below knee amputations, and open tibia fractures would require the most demand for injury care. Assessing the combined impact of frequency and human resource cost indicated that knee and ankle ligamentous injuries and closed tibia fractures had the greatest impact on unit readiness. Responses also indicated that a variety of materials would be available for applying or improvising splints.

Conclusion: Although the combined impact of knee and ankle ligamentous injuries were ranked the highest, limitations in relative rankings and the existence of effective low-cost treatments for these injuries suggest that greater gains in unit effectiveness would come from focusing on developing solutions for fractures with higher human resource cost, such as leg and arm fractures. This information can be used to develop enhanced splints that can preserve unit readiness in the field.

ORTHOPEDIC TRAUMA

Are Drains Associated with Infection after Operative Fixation of High-Risk Tibial Plateau and Pilon Fractures?

Boissonneault A, O'Toole RV, Hayda R, Reid JS, Caroom C, Carlini A, Dagal A, Castillo R, Karunakar M, Matuszewski PE, Hymes R, O'Hara NN; **METRC.**

Objectives: To determine the association between closed suction drainage and postoperative infection in patients with tibial plateau or pilon fractures. Secondarily, this study assessed whether intrawound vancomycin powder modified the association of closed surgical drains with infection.

Design: Secondary analysis of the Effect of Intrawound Vancomycin Powder in Operatively Treated High-risk Tibia Fractures: A Randomized Clinical Trial (VANCO).

Setting: Thirty-six academic trauma centers.

Patient selection criteria: All patients with high-risk tibia fractures Orthopaedic Trauma Association/ Arbeitsgemeinschaft fur Osteosynthesefragen (OTA/AO classification 41B/C or 43B/C) from the VANCO trial were considered. Closed suction drains were placed based on the treating surgeon's discretion. Patients were randomly assigned to receive 1-gram intrawound vancomycin powder in the surgical wound at definitive fixation or the standard infection prevention protocol at each center.

Outcome measures and comparisons: Deep surgical site infection (SSI) within 6 months. Comparisons were made between patients treated with and without drains. Subgroup analysis also examined the effect

of drains in patients with and without intrawound vancomycin powder.

Results: Of the 978 study patients, 197 (20%) were treated with drains. Deep infection rates did not significantly differ between patients with or without surgical drains (8% vs. 8%, P = 0.88). However, intrawound vancomycin powder significantly modified the association of surgical drains on deep SSI (interaction P = 0.048). Specifically, patients with drains but no vancomycin powder had the highest deep infection rate (13%; 95% confidence interval, 6%-19%). When vancomycin powder was used in addition to a drain, deep SSI rates were reduced by 10% (95% confidence interval, 2%-17%, P = 0.01).

Conclusions: This study suggests that closed suction drains after operative fixation of high-risk tibia fractures may not be associated with deep infection in general. However, a secondary analysis raises the possibility that drains are associated with reduced deep infection rates if topical vancomycin powder is used but associated with increased infection rates if vancomycin powder is not used.

A machine learning model to predict surgical site infection after surgery of lower extremity fractures

Gutierrez-Naranjo, J., Moreira, A., Valero-Moreno, E., Bullock, T., Ogden, L., & **Zelle, B.**

Purpose: This study aimed to develop machine learning algorithms for identifying predictive factors associated with the risk of postoperative surgical site infection in patients with lower extremity fractures.

Methods: A machine learning analysis was conducted on a dataset comprising 1,579 patients who underwent surgical fixation for lower extremity fractures to create a predictive model for risk stratification of postoperative surgical site infection. We evaluated different clinical and demographic variables to train four machine learning models (neural networks, boosted generalised linear model, naïve bayes, and penalised discriminant analysis). Performance was measured by the area under the curve score, Youdon's index and Brier score. A multivariate adaptive regression splines (MARS) was used to optimise predictor selection.

Results: The final model consisted of five predictors. (1) Operating room time, (2) ankle region, (3) open injury, (4) body mass index, and (5) age. The best-performing machine learning algorithm demonstrated a promising predictive performance, with an area under the ROC curve, Youdon's index, and Brier score of 77.8%, 62.5%, and 5.1%-5.6%, respectively.

Conclusion: The proposed predictive model not only assists surgeons in determining high-risk factors for surgical site infections but also empowers patients to closely monitor these factors and take proactive measures to prevent complications. Furthermore, by considering the identified predictors, this model can serve as a reference for implementing preventive measures and reducing postoperative complications, ultimately enhancing patient outcomes. However, further investigations involving larger datasets and external validations are required to confirm the reliability and applicability of our model.

Does Topical Vancomycin Powder Use in Fracture Surgery Change Bacteriology and Antibiotic Susceptibilities?

Joshi, M., O'Toole, R., Carlini, A., Gary, J., Obremskey, W., Murray, C., Gaski, G., Reid, J., Degani, Y., Taylor, T., Collins, S., Huang, Y., Whiting, P., Patterson, J., Lee, O., Castillo, R., Bosse, M., Hsu, J.,

Karunakar, M., Kempton, L., Seymour, R., Sims, S., Churchill, C., Carroll, E., Goodman, J., Holden, M., Gardner, M., Miller, A., Spraggs-Hughes, A., Brennan, M., Weaver, M., Rivera, J., Kimmel, J., Reilly, R., Zura, R., Howes, C., Mir, H., Schmidt, A, Wagstrom, E., Westberg, J., McKinley, T., Natoli, R., Sorkin, A., Virkus, W., Hill, L., Hymes, R., Holzman, M., Malekzadeh, A., Schulman, J., Schwartzbach, C., Krause, P., Choo, A., Boutte, S., Frisch, H., Kaufman, A., Large, T., Lecroy, C., Smith, C., Horne, A., Lebrun, C., Nascone, J., O'Hara, N., Sciadini, M., Slobogean, G., Howe, A., Rudnicki, J., Evans, A., Sietsema, D., Stawicki, S., Wojda, T., Bishop, J., Rehman, S., Caroom, C., Ly, T., Sheridan, E., Haller, J, Bergin, P., Bhanat, E., Graves, M., Jones, L., Morellato, J., Spitler, C., Teague, D., Ertl, W., Moloney, G., Weinlein, J., **Zelle, B., Agarwal, A., Karia, R.,** Sathy, A., Sanders, D., Weiss, D., Yarboro, S., Lester-Ballard, V., McVey, E., Firoozabadi, R., Simske, N., Siy, A., Attum, B., Burgos, E., Gajari, V., Rodriguez-Buitrago, A., Sethi, M., Trochez, K., & Allen, L.

Objective: To determine whether intrawound vancomycin changes the bacteriology of surgical site infection pathogens and investigate the emergence of antibiotic-resistant pathogens.

Design: Secondary analysis of phase III, prospective, randomized clinical trial.

Setting: Thirty-six US trauma centers.

Patient selection criteria: Patients who became infected after fixation of tibial plateau or pilon fracture.

Outcome measures and comparisons: Pathogen types and bacterial susceptibilities as determined from routine clinical culture in the operating room.

Results: Seventy-four patients were studied who were 67.5% male with a mean age of 48.6 years. A lower proportion of gram-positive cocci was observed in the vancomycin powder compared with the standard-of-care group (3.7% vs. 8.0%, P = 0.01). Methicillin-resistant Staphylococcus aureus infection incidence was comparable in both the vancomycin powder and the standard-of-care groups, but rates of methicillin-susceptible S. aureus infections were lower in the treatment group (1.4% vs. 4.8%, P = 0.01). The incidence of coagulase-negative Staphylococci and gram-negative rod infections were similar in both groups. There was no significant difference in susceptibilities between groups in rates of vancomycin-resistant enterococcus.

Conclusions: Topical vancomycin powder decreases the likelihood of gram-positive infections consistent with the biologic activity of vancomycin. Fewer methicillin-susceptible S. aureus and coagulase-negative Staphylococci infections were observed in the group treated with vancomycin powder. An effect of vancomycin powder on methicillin-resistant S. aureus infection risk was not detected given the low incidence in both the intrawound vancomycin and the standard-of-care groups. There was no emergence of gram-negative rod infections or increased resistance patterns observed. Use of topical vancomycin powder does not seem to produce infections in these patients with greater antibiotic resistance than would have occurred without its use.

Early major fracture care in polytrauma—priorities in the context of concomitant injuries: A Delphi consensus process and systematic review

Pfeifer, R., Klingebiel, F., Balogh, Z., Beeres, F., Coimbra, R., Fang, C., Giannoudis, P., Hietbrink, F., Hildebrand, F., Kurihara, H., Lustenberger, T., Marzi, I., Oertel, M., Peralta, R., Rajasekaran, S., Schemitsch, E., Vallier, H., **Zelle, B.**, Kalbas, Y., Pape, H.

Background: The timing of major fracture care in polytrauma patients has a relevant impact on outcomes. Yet, standardized treatment strategies with respect to concomitant injuries are rare. This study aims to provide expert recommendations regarding the timing of major fracture care in the presence of concomitant injuries to the brain, thorax, abdomen, spine/spinal cord, and vasculature, as well as multiple fractures.

Methods: This study used the Delphi method supported by a systematic review. The review was conducted in the Medline and EMBASE databases to identify relevant literature on the timing of fracture care for patients with the aforementioned injury patterns. Then, consensus statements were developed by 17 international multidisciplinary experts based on the available evidence. The statements underwent repeated adjustments in online- and in-person meetings and were finally voted on. An agreement of ≥75% was set as the threshold for consensus. The level of evidence of the identified publications was rated using the GRADE approach.

Results: A total of 12,476 publications were identified, and 73 were included. The majority of publications recommended early surgery (47/73). The threshold for early surgery was set within 24 hours in 45 publications. The expert panel developed 20 consensus statements and consensus >90% was achieved for all, with 15 reaching 100%. These statements define conditions and exceptions for early definitive fracture care in the presence of traumatic brain injury (n = 5), abdominal trauma (n = 4), thoracic trauma (n = 3), multiple extremity fractures (n = 3), spinal (cord) injuries (n = 3), and vascular injuries (n = 2).

Conclusion: A total of 20 statements were developed on the timing of fracture fixation in patients with associated injuries. All statements agree that major fracture care should be initiated within 24 hours of admission and completed within that timeframe unless the clinical status or severe associated issues prevent the patient from going to the operating room.

Who Is Treating Periprosthetic Femur Fractures? An Analysis of the Periprosthetic Research Consortium

Pohl, N., Saxena, A., Stambough, J., Martin, J., Mears, S., **Buttacavoli, F. & Karia, R.**

Background: Periprosthetic femur fractures (PPFFs) following total hip arthroplasty (THA) have increased in the past decade as the demand for primary surgery continues to grow. Although there is now more evidence to describe the treatment of Vancouver B fractures, there is still limited knowledge regarding factors that cause surgeons to perform either an open reduction and internal fixation (ORIF) or revision THA (rTHA). The purpose of this study was to determine what type of surgeons treat Vancouver B PPFFs at 11 major academic institutions and if there are trends in treatment decision-making regarding the use of ORIF or rTHA based on surgical training or patient factors.

Methods: This multicenter retrospective study evaluated patients surgically treated for Vancouver B PPFF after THA between 2014 and 2019. Patients from 11 academic centers located in the United States were included in this study. Surgical outcomes and patient demographics were evaluated based on surgeon training, surgical treatment type, and institution.

Results: Presence of Vancouver B2 (odds ratio [OR]: 0.02, P < .001) or B3 (OR: 0.04, P < .001) fractures were independent risk factors for treatment with rTHA. Treatment by a trauma (OR: 12.49, P < .001) or other-specified surgeon (OR: 13.63, P < .001) were independent risk factors for ORIF repair of Vancouver B fractures. There were no differences in outcomes based on surgeon subspecialty training.

Conclusions: This study showed the trends in surgeons who surgically manage Vancouver B fractures at 11 major academic institutions and highlighted that regardless of surgical training or surgical treatment type, postoperative outcomes following management of PPFF were similar.

Angioembolization Has Similar Efficacy and Lower Total Charges than Preperitoneal Pelvic Packing in Patients With Pelvic Ring or Acetabulum Fractures

Singh, A., Kotzur, T., Koslosky, E., Gonuguntla, R., Canseco, L., Momtaz, D., Seifi, A., & **Martin, C.**

Objectives: To compare cost, hospital-related outcomes, and mortality between angioembolization (AE) and preperitoneal pelvic packing (PPP) in the setting of pelvic ring or acetabulum fractures.

Design: Retrospective database review.

Setting: National Inpatient Sample, years 2016-2020.

Patient selection criteria: Hospitalized adult patients who underwent AE or PPP in the setting of a pelvic ring or acetabulum fracture.

Outcome measures and comparisons: Mortality and hospital-associated outcomes, including total charges, following AE versus PPP in the setting of pelvic ring or acetabulum fractures.

Results: A total of 3780 patients, 3620 undergoing AE and 160 undergoing PPP, were included. No significant differences in mortality, length of stay, time to procedure, or discharge disposition were found ($P > 0.05$); however, PPP was associated with significantly greater charges than AE ($P = 0.04$). Patients who underwent AE had a mean total charge of $250,062.88 while those undergoing PPP had a mean total charge of $369,137.16.

Conclusions: Despite equivalent clinical efficacy in terms of mortality and hospital-related outcomes, PPP was associated with significantly greater charges than AE in the setting of pelvic ring or acetabulum fractures. This data information can inform clinical management of these patients and assist trauma centers in resource allocation.

A component-based analysis of metabolic syndrome's impact on 30-day outcomes after hip fracture: reduced mortality in obese patients

Singh, A., Kotzur, T., Vivancos-Koopman, I., Emukah, C., Brady, C., & **Martin, C.**

Introduction: Hip fractures are a common injury associated with significant morbidity and mortality. In the United States, there has been a rapid increase in the prevalence of metabolic syndrome (MetS), a condition comprised several common comorbidities, including obesity, diabetes mellitus, and hypertension, that may worsen perioperative outcomes. This article assesses the impact of MetS and its components on outcomes after hip fracture surgery.

Methods: Patients who underwent nonelective operative treatment for traumatic hip fractures were identified in the 2015-2020 American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database. Baseline characteristics between groups were compared, and significant differences were included as covariates. Multivariate regression was performed to assess the impact of characteristics of interest on postoperative outcomes. Patients with MetS, or a single one of its constitutive components-hypertension, diabetes, and obesity-were compared with metabolically healthy cohorts.

Results: In total 95,338 patients were included. Patients with MetS had increased complications (OR

1.509; P < 0.001), but reduced mortality (OR 0.71; P < 0.001). Obesity alone was also associated with increased complications (OR 1.14; P < 0.001) and reduced mortality (OR 0.736; P < 0.001). Both hypertension and diabetes alone increased complications (P < 0.001) but had no impact on mortality. Patients with MetS did, however, have greater odds of adverse discharge (OR 1.516; P < 0.001), extended hospital stays (OR 1.18; P < 0.001), and reoperation (OR 1.297; P = 0.003), but no significant difference in readmission rate.

Conclusion: Patients with MetS had increased complications but decreased mortality. Our component-based analysis showed had obesity had a similar effect: increased complications but lower mortality. These results may help surgeons preoperatively counsel patients with hip fracture about their postoperative risks.

Going Solo: Techniques for Emergency Fracture Management Without Assistance

Verlinsky, L., McDonald, C., & **Hand, T.**

Orthopaedic injuries represent some of the most frequent conditions treated in emergency centers worldwide. Proper reduction techniques and evaluation of radiographic parameters are paramount in treating patients effectively. Orthopaedic providers at large tertiary centers may have several assistants available but are also burdened by notable patient loads and volumes. Frequently, fracture care may necessitate procedures performed by providers without the availability of skilled assistance, both in large tertiary academic centers and small independent emergency rooms with limited resources. As providers at a busy level 1 tertiary trauma center with only one primary orthopaedic resident responsible for the performance of most fracture reductions, we present both novel techniques and refined published approaches that allow the safe, efficient, and reliable reduction and stabilization of several different types of fracture dislocations with limited or no assistance, and only commonly found supplies.

Health Disparities in Patients With Musculoskeletal Injuries: Food Insecurity Is a Common and Clinically Challenging Problem

Vo, L., Verlinsky, L., Jakkaraju, S., Guerra, A., & **Zelle, B.**

Background: Health disparities have important effects on orthopaedic patient populations. Socioeconomic factors and poor nutrition have been shown to be associated with an increased risk of complications such as infection in patients undergoing orthopaedic surgery. Currently, there are limited published data on how food insecurity is associated with medical and surgical complications.

Questions/purposes: We sought to (1) determine the percentage of patients who experience food insecurity in an orthopaedic trauma clinic at a large Level 1 trauma center, (2) identify demographic and clinical factors associated with food insecurity, and (3) identify whether there are differences in the risk of complications and reoperations between patients who experience food insecurity and patients who are food-secure.

Methods: This was a cross-sectional study using food insecurity screening surveys, which were obtained at an orthopaedic trauma clinic at our Level 1 trauma center. All patients 18 years and older who were seen

for an initial evaluation or follow-up for fracture care between November 2022 and February 2023 were considered for inclusion in this study. For inclusion in this study, the patient had to have surgical treatment of their fracture and have completed at least one food insecurity screening survey. Ninety-eight percent (121 of 123) of patients completed the screening survey during the study period. Data for 21 patients were excluded because of nonoperative treatment of their fracture, nonfracture-related care, impending metastatic fracture care, and patients who had treatment at an outside facility and were transferring their care. This led to a study group of 100 patients with orthopaedic trauma. The mean age was 51 years, and 51% (51 of 100) were men. The mean length of follow-up available for patients in the study was 13 months from the initial clinic visit. Patient demographics, hospital admission data, and outcome data were collected from the electronic medical records. Patients were divided into two cohorts: food-secure versus food-insecure. Patients were propensity score matched for adjusted analysis.

Results: A total of 37% of the patients in this study (37 of 100) screened positive for food insecurity during the study period. Patients with food insecurity were more likely to have a higher BMI than patients with food security (32 kg/m 2 compared with 28 kg/m 2 ; $p = 0.009$), and they were more likely not to have healthcare insurance or to have Medicaid (62% [23 of 37] compared with 30% [19 of 63]; $p = 0.003$). After propensity matching for age, gender, ethnicity, current substance use, Charleston comorbidity index, employment status, open fracture, and length of stay, food insecurity was associated with a higher percentage of superficial infections (13% [4 of 31] compared with 0% [0 of 31]; $p = 0.047$). There were no differences between the groups in the risk of reoperation, deep infection, and nonunion.

Conclusion: Food insecurity is common among patients who have experienced orthopaedic trauma, and patients who have it may be at increased risk of superficial infections after surgery. Future research in this area should focus on defining these health disparities further and interventions that could address them.

PEDIATRIC ORTHOPEDICS

Native American Representation and Diversity Initiatives Within Orthopaedic Surgery: An Update and Road Map to Success

Jodoin, Z., Williamson, T., Poon, S., & **McCormick, S.**

Orthopaedic surgery lags behind other specialties in terms of diversity. This lack of representation is especially evident within the Native American population. Native American/Alaskan Natives represent approximately 2.9% of the overall US population but comprise just 0.4% of orthopaedic surgeons within the United States. Currently, no Native American–specific orthopaedic inclusion or recruitment programs exist. There are a multitude of programs that exist to recruit Native American applicants into health care. These include pipeline programs and scholarships from the Indian Health Service (IHS), mentorship programs from a multitude of Native American medical societies, and IHS recruitment programs targeted at Native American preferential hiring. Dozens of grants and national diversification programs that are not specific to Native Americans are also available. Programs such as the AAOS IDEA Grant, Nth Dimensions, and The Perry Initiative have been successful in diversifying the orthopaedic surgery pipeline. This review highlights the paucity of Native American representation within orthopaedics and identifies current programs and resources for Native Americans. This article serves as a guide for Native Americans pursuing a career in orthopaedic surgery, as well as inspiration for future programs directed at increasing Native American representation.

A comparison of screw and suture button fixation in the management of adolescent ankle syndesmotic injuries

Verlinsky, L., **Heath, D.**, Momtaz, D., Christopher, B., Singh, A., & **Gibbons, S.**

Purpose: Ankle injuries involving the tibiofibular syndesmosis often necessitate operative fixation to restore stability to the ankle. Recent literature in the adult population has suggested that suture button fixation may be superior to screw fixation. There is little evidence as to which construct is preferable in the pediatric and adolescent population. This study investigates outcomes of suture button and screw fixation in adolescent ankle syndesmotic injuries.

Methods: A retrospective matched cohort study over 10 years of pediatric patients who underwent ankle syndesmotic fixation at a large Level 1 Trauma Center was conducted. Both isolated syndesmotic injuries and ankle fractures with syndesmotic disruption were included. Preoperative variables collected include basic patient demographics, body mass index, and fracture type. Suture button and screw cohorts were matched based on age, race, sex, and open fracture utilizing propensity scores. Outcomes assessed include reoperation and implant failure.

Results: A total of 44 cases of operative fixation of the ankle syndesmosis were identified with a mean age of 16 years. After matching cohorts based on age, sex, race, and open fracture status, there were 17 patients in the suture button and screw cohorts, respectively. Patients undergoing screw fixation had a six times greater risk of reoperation ($p = 0.043$) and 13 times greater risk of implant failure ($p < 0.001$). Out of six cases of reoperation in the screw cohort, five were unplanned.

Conclusion: Our findings favor suture button fixation in operative management of adolescent tibiofibular syndesmotic injuries. Compared with screws, suture buttons are associated with lower risk of both reoperation and implant failure.

PODIATRY

Update of biomarkers to diagnose diabetic foot osteomyelitis: A meta-analysis and systematic review

Ansert, E., **Tarricone, A.,** Coye, T., Crisologo, P., Truong, D., Suludere, M., & **Lavery, L.**

The aim of this study was to evaluate the diagnostic characteristics of biomarker for diabetic foot osteomyelitis (DFO). We searched PubMed, Scopus, Embase and Medline for studies who report serological markers and DFO before December 2022. Studies must include at least one of the following diagnostic parameters for biomarkers: area under the curve, sensitivities, specificities, positive predictive value, negative predictive value. Two authors evaluated quality using the Quality Assessment of Diagnostic Accuracy Studies tool. We included 19 papers. In this systematic review, there were 2854 subjects with 2134 (74.8%) of those patients being included in the meta-analysis. The most common biomarkers were erythrocyte sedimentation rate (ESR), C-reactive protein (CRP) and procalcitonin (PCT). A meta-analysis was then performed where data were evaluated with Forrest plots and receiver operating characteristic curves. The pooled sensitivity and specificity were 0.72 and 0.75 for PCT, 0.72 and 0.76 for CRP and 0.70 and 0.77 for ESR. Pooled area under the curves for ESR, CRP and PCT were 0.83, 0.77 and 0.71, respectfully. Average diagnostic odds ratios were 16.1 (range 3.6-55.4), 14.3 (range 2.7-48.7) and 6.7 (range 3.6-10.4) for ESR, CRP and PCT, respectfully. None of the biomarkers we evaluated could be rated as 'outstanding'

to diagnose osteomyelitis. Based on the areas under the curve, ESR is an 'excellent' biomarker to detect osteomyelitis, and CRP and PCT are 'acceptable' biomarkers to diagnose osteomyelitis. Diagnostic odds ratios indicate that ESR, CRP and PCT are 'good' or 'very good' tools to identify osteomyelitis.

Guidelines on the prevention of foot ulcers in persons with diabetes (IWGDF 2023 update)

Bus, S., Sacco, I., Monteiro-Soares, M., Raspovic, A., Paton, J., Rasmussen, A., **Lavery, L.**, & van Netten, J.

Aims: This is the 2023 International Working Group on the Diabetic Foot guideline on the prevention of foot ulcers in persons with diabetes, which updates the 2019 guideline. This guideline is targeted at clinicians and other healthcare professionals.

Materials and methods: We followed the Grading of Recommendations, Assessment, Development and Evaluations methodology to devise clinical questions and critically important outcomes in the PICO format, to conduct a systematic review of the medical-scientific literature including, where appropriate, meta-analyses, and to write recommendations and their rationale. The recommendations are based on the quality of evidence found in the systematic review, expert opinion where (sufficient) evidence was not available, and a weighing of the desirable and undesirable effects of an intervention, as well as patient preferences, costs, equity, feasibility and applicability.

Results: We recommend screening a person with diabetes at very low risk of foot ulceration annually for the loss of protective sensation and peripheral artery disease, and screening persons at higher risk at higher frequencies for additional risk factors. For preventing a foot ulcer, educate persons at-risk about appropriate foot self-care, educate not to walk without suitable foot protection, and treat any pre-ulcerative lesion on the foot. Educate moderate-to-high risk people with diabetes to wear properly fitting, accommodative, therapeutic footwear, and consider coaching them to monitor foot skin temperature. Prescribe therapeutic footwear that has a demonstrated plantar pressure relieving effect during walking, to help prevent plantar foot ulcer recurrence. Consider advising people at low-to-moderate risk to undertake a, preferably supervised, foot-ankle exercise programme to reduce ulcer risk factors, and consider communicating that a total increase in weight-bearing activity of 1000 steps/day is likely safe with regards to risk of ulceration. In people with non-rigid hammertoe with pre-ulcerative lesion, consider flexor tendon tenotomy. We suggest not to use a nerve decompression procedure to help prevent foot ulcers. Provide integrated foot care for moderate-to-high-risk people with diabetes to help prevent (recurrence of) ulceration.

Conclusions: These recommendations should help healthcare professionals to provide better care for persons with diabetes at risk of foot ulceration, to increase the number of ulcer-free days and reduce the patient and healthcare burden of diabetes-related foot disease.

Infected Wound Bed Management: The Diabetic Foot

Clerici, G., Casini, A., Losurdo, F., Valeria Rusu, I., & **Frykberg, R.**

The expression “Diabetic Foot” (DF) refers to any infection, ulceration, or destruction of foot tissues occurring in a person with diabetes mellitus, usually associated to peripheral neuropathy and/or peripheral artery disease (PAD). DF lesions can be classified according to their main cause into neuropathic, ischemic, neuro-ischemic, and infected. Neuropathic ulcers occur in high pressure points and are best treated

with offloading. Ischemic lesions occur mostly at the extremities and require restoration of adequate blood flow to aim for healing. Neuro-ischemic lesions combine features of neuropathic and ischemic feet. Any diabetic foot lesion can complicate with infection that may range from mild and uncomplicated to limb- or life-threatening conditions. The mainstay of life-threatening diabetic foot infections and of limb-threatening conditions associated with deep purulent collections or rapid clinical worsening is immediate surgical debridement. Several clinico-pathologic entities may be responsible of a diabetic foot infection. The most commonly encountered in clinical practice are suppurative deep infections (e.g., abscesses and phlegmons), wet gangrene, necrotizing fasciitis, cellulitis, erysipelas, and diabetic foot osteomyelitis (DFO). Diagnosing DFO is often difficult and is based on a combination of clinical, radiological, and laboratory findings when culture and histology are not available. DFO treatment could be mainly surgical or mainly medical according to the extension of the infective process and patient's surgical risk profile. A biopsy for culture and sensitivity testing is always advisable in order to drive appropriate antibiotic treatment and avoid selection of multi-drug-resistant germs.

Healing rates and outcomes following closed transmetatarsal amputations: A systematic review and random effects meta-analysis of proportions

Coye, T., Ansert, E., Suludere, M., Chung, J., Kang, G., & **Lavery, L.**

Transmetatarsal amputation (TMA) is a common surgical procedure for addressing severe forefoot pathologies, such as peripheral vascular disease and diabetic foot infections. Variability in research methodologies and findings within the existing literature has hindered a comprehensive understanding of healing rates and complications following TMA. This meta-analysis and systematic review aims to consolidate available evidence, synthesising data from multiple studies to assess healing rates and complications associated with closed TMA procedures. Following Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines, a systematic search of Medline, Embase, and Cochrane databases was conducted for articles published from January 1st, 1988, to June 1st, 2023. Inclusion criteria comprised studies reporting healing rates in non-traumatic transmetatarsal amputation patients with more than 10 participants, excluding open TMAs. Two independent reviewers selected relevant studies, with disagreements resolved through discussion. Data extracted from eligible studies included patient demographics, healing rates, complications, and study quality. Among 22 studies encompassing 1569 transmetatarsal amputations, the pooled healing rate was 67.3%. Major amputation rates ranged from 0% to 55.6%, with a random-effects pooled rate of 23.9%. Revision rates varied from 0% to 36.4%, resulting in a pooled rate of 14.8%. 30-day mortality ranged from 0% to 9%, with a fixed-effects pooled rate of 2.6%. Post-operative infection rates ranged from 3.0% to 30.7%, yielding a random-effects pooled rate of 16.7%. Dehiscence rates ranged from 1.7% to 60.0%, resulting in a random-effects pooled rate of 28.8%. Future studies should aim for standardised reporting and assess the physiological and treatment factors influencing healing and complications.

The infected diabetic foot: Modulation of traditional biomarkers for osteomyelitis diagnosis in the setting of diabetic foot infection and renal impairment

Coye, T., Crisologo, P., Suludere, M, Malone, M., Oz, O., & **Lavery, L.**

The objective of this paper was to investigate erythrocyte sedimentation rate (ESR) and c-reactive protein (CRP) in diagnosing pedal osteomyelitis (OM) in patients with and without diabetes, and with and without severe renal impairment (SRI). This was a retrospective cohort study of patients with moderate and severe foot infections. We evaluated three groups: Subjects without diabetes (NDM), subjects with diabetes and without severe renal insufficiency (DM-NSRI), and patients with diabetes and SRI (DM-SRI). SRI was defined as eGFR <30. We evaluated area under the curve (AUC), cutoff point, sensitivity and specificity to characterize the accuracy of ESR and CRP to diagnose OM. A total of 408 patients were included in the analysis. ROC analysis in the NDM group revealed the AUC for ESR was 0.62, with a cutoff value of 46 mm/h (sensitivity, 49.0%; specificity, 76.0%). DM-NSRI subjects showed the AUC for ESR was 0.70 with the cutoff value of 61 mm/h (sensitivity, 68.9%; specificity 61.8%). In DM-SRI, the AUC for ESR was 0.67, with a cutoff value of 119 mm/h (sensitivity, 46.4%; specificity, 82.40%). In the NDM group, the AUC for CRP was 0.55, with a cutoff value of 6.4 mg/dL (sensitivity, 31.3%; specificity, 84.0%). For DM-NSRI, the AUC for CRP was 0.70, with a cutoff value of 8 mg/dL (sensitivity, 49.2%; specificity, 80.6%). In DM-SRI, the AUC for CRP was 0.62, with a cutoff value of 7 mg/dL (sensitivity, 57.1%; specificity, 67.7%). While CRP demonstrated relatively consistent utility, ESR's diagnostic cutoff points diverged significantly. These results highlight the necessity of considering patient-specific factors when interpreting ESR results in the context of OM diagnosis.

Development of Cyclic Pressure Offloading Insole for Diabetic Foot Ulcer Prevention

Erel, V., Nasirian, A., Gu, Y., **Lavery, L.,** & Wijesundara, M.

Introduction: The likelihood of developing a diabetic foot ulcer (DFU) during one's lifetime for individuals with diabetes mellitus is around 19% to 34%. Continuous and repetitive loading on soft tissues are the major causative factors for DFU. This paper introduces an air cell array insole designed for cyclically offloading pressure from plantar regions to reduce repetitive stress and loading on foot. **Materials and Methods:** The insole comprises an air cell array insole and a pneumatic control unit. The interface pressure was evaluated in static and dynamic conditions at 3 different air cell internal pressures (6.9, 10.3, and 13.8 kPa). Plantar interface pressure was measured using a commercial pressure system, and data were analyzed using paired t test. Average interface pressure and peak pressure (PP) were studied to evaluate the functionality and effectiveness of the insole. Results. The analysis of static pressure data revealed that cyclic offloading significantly ($p < .05$) reduced PP in 4 tested cells corresponding to big toe, metatarsal heads, and heel areas with the maximum mean difference of 12.9 kPa observed in big toe region. Similarly, dynamic pressure data analysis showed that cyclic offloading significantly ($p < .05$) reduced PP in these areas, with the highest mean PP reduction of 36.98 kPa in the big toe region.

Discussion: Results show the insole's capability to reduce plantar pressure through cyclic offloading. Internal pressure of air cells significantly affects the overall pressure reduction and must be chosen based on the user's weight.

Conclusion: Results confirm that the insole with offloading capabilities has the potential to reduce the risk of developing DFUs by alleviating the plantar stress during both static and dynamic conditions.

Assessing placental membrane treatment efficiency in diabetic foot ulcers: Processing for retention versus lamination

Frykberg, R., & Tunyiswa, Z.

Background: Diabetic foot ulcers are a severe complication in diabetic patients, significantly impact healthcare systems and patient quality of life, often leading to hospitalization and amputation. Traditional Standard of Care (SOC) treatments are inadequate for many patients, necessitating advanced wound care products (AWCPs) like human placental membranes. This study conducts a retrospective analysis to compare the effectiveness of two human placental membrane products, retention-processed amnion chorion (RE-AC) and lamination-processed amnion chorion (L-AC) in managing chronic diabetic foot ulcers (DFUs).

Methods: The study collected retrospective observational data from electronic health records (EHRs) of patients treated for DFU at three outpatient wound care centers. Patients were categorized into two cohorts based on the treatment received. Key metrics included wound size progression and the number of product applications. The analysis employed Bayesian estimation, utilizing an analysis of covariance model with a Hurdle Gamma likelihood.

Results: We found that RE-AC achieved a marginally higher expected Percent Area Reduction (xPAR) in DFUs compared to L-AC at 12 weeks (67.3% vs. 52.6%). RE-AC also required fewer applications, suggesting greater efficiency in general wound closure. Probability of full wound closure was similar in both groups (0.738 vs 0.740 in RE-AC and L-AC, respectively).

Conclusion: The findings suggest that while L-AC might be slightly more effective in complete ulcer healing, RE-AC offers overall better treatment efficiency, especially in reducing the frequency of applications. This efficiency can lead to improved patient comfort, reduced treatment costs, and optimized resource utilization in healthcare settings.

Retention processed placental membrane versus standard of care in treating diabetic foot ulcers

Frykberg, R., Tunyiswa, Z., & Weston, W.

Diabetic foot ulcers (DFUs) are a severe complication for diabetic patients, significantly impacting patient quality of life and healthcare system efficiency. Traditional standard of care (SOC) treatments are inadequate for many patients, necessitating the use of advanced wound care products, such as human placental membranes. We studied a real-world population of large, hard-to-heal and complicated wounds, otherwise under-studied in the wound care literature. To this end, we conducted a retrospective cohort analysis to compare the effectiveness of a human placental amnion/chorion membrane product using retention-based processing (RE-AC) and SOC in managing chronic DFUs. During the study period of September 2021 through April 2024, we collected retrospective observational data from electronic health records of 21 patients treated with RE-AC at three outpatient wound care centres. Additionally, 21 control SOC patients were matched from a wound registry using Coarsened Exact Matching. Patients were categorized into two cohorts based on whether they received RE-AC or SOC. Key metrics included wound size progression and wound closure. The analysis employed Bayesian regression and Hurdle Gamma Analysis of Covariance models. Despite their rather large size (average of 13.8 cm2), our results indicated that RE-AC achieved

almost a 10% higher expected wound closure rate compared to SOC at 12 weeks (8.53% [credible interval: 5.60%-10.7%]). Further, for wounds that did not close, RE-AC resulted in a 93.6% (credible interval: 147.7%-41.6) improvement in expected Percent Area Reduction over the SOC group at 12 weeks. We noted that on average, SOC wounds stalled or grew larger. In terms of a risk ratio comparing the study group with SOC, we found a 52% benefit in the RE-AC group (RR = 1.52). The findings suggest that even with larger DFUs, R-AC is superior to SOC for wound closure and expected Percent Area Reduction by 12 weeks. This benefit likely leads to reduced treatment costs, optimized resource utilization and improved outcomes in the DFU patient population; ultimately resulting in improved patient care.

The Role of Intravascular Ultrasound in Limb Salvage: A Systematic Review and Meta-Analysis

Gee, A., **Tarricone, A., Lavery, L.**, Wiley, K., Palmieri, N., Sharma, S., & Krishnan, P.

Purpose: The purpose of this study was to review the current literature of intravascular ultrasound (IVUS) use in real world cohorts inclusive of chronic limb threatening ischemia (CLTI) patients and compare the outcomes to patients imaged by angiography alone.

Methods: The systematic review was registered in Research Registry. A literature search was performed across 4 databases: PubMed, Medline/Embase, Cochrane Review, and Web of Science for eligible comparative studies. The primary outcomes examined were clinically driven target lesion revascularization (CD-TLR), amputation (including minor below the ankle and major above the ankle), all-cause mortality, limb salvage and mean balloon dilation. A random effects model was used when pooling outcomes to account for heterogeneity. Publication bias was determined using eggers test and illustrated on a funnel plot.

Main findings: Six studies were included in this review, with a total of 1883 subjects with Rutherford 1-6. Among the 1883 subjects, 940 had Rutherford 4-6. IVUS was used in 1294 subjects and angiography alone was used in 589 subjects. Pooled analysis determined no significant association in IVUS + angiography with CD-TLR (O.R = 1.43 [CI: 0.80, 2.58]), all-cause amputation (O.R = 0.63 [CI: 0.34, 1.17]), and all-cause mortality (O.R = 0.63 [CI: 0.34, 1.17]). Sub analysis of subjects with CLTI, Rutherford classes 4-6 showed an association between IVUS + angiography use with limb salvage at 1 year, O.R = 2.22 [1.24, 3.97].

Conclusion: The use of IVUS + angiography compared to angiography alone showed larger reference vessel diameter in both all-inclusive Rutherford classifications and the CLTI subset. The use of IVUS + angiography compared to angiography alone showed no difference in CD-TLR at 12 months, lower extremity amputation, and all-cause mortality for Rutherford 1-6. The use of IVUS + angiography compared to angiography alone in the CLTI subset analysis improved limb salvage.

Management of Talus Fractures [Review]

Hamilton, G., Doyle, M., & Ligas, C.

Fractures of the talus are life-changing events. The talus is of vital importance to normal gait. Given its importance, great care is needed in diagnosing and treating these injuries. The threshold for operative treatment and accurate anatomic reduction should be low. Surgical tenets include the avoidance of extensive subperiosteal dissection to minimize vascular disruption. The complications with injuries to the talus are extensive and include avascular necrosis (AVN). Although AVN can prove to be a devastating sequela from this injury, it occurs less frequently than posttraumatic arthritis.

Health professionals involved in diabetic foot and their tasks in a country without podiatrists: From a Japanese Nationwide Survey

Izumi, Y., Onishi, H., & **Lavery, L.**

Although there are no podiatrists in 85% of countries worldwide, how diabetic foot is managed in those countries is still unknown. We sought to identify the health professionals involved in diabetic foot and their tasks in Japan, where no podiatrists exist. This cross-sectional study used the Japanese Nationwide Survey on Foot Ulcer Management dataset, consisting of 249 medical doctors and 680 allied health professionals. The types of health professionals involved in the diabetic foot were identified, and the tasks performed by each professional were compared within subgroups (medical doctors and allied health professionals). We found that the primary medical doctors involved in diabetic foot care in Japan were plastic surgeons (33.5%), dermatologists (21%), cardiovascular/vascular surgeons (15.2%), and cardiologists (12.1%). Nurses were the main allied health professionals (80%), and the rest consisted of prosthetists/orthotists (7.6%), physical/occupational therapists (5.9%), and clinical engineering technologists (3.6%). Medical doctors performed tasks related to their specialties significantly more than others ($p < 0.001$); however, they also engaged in tasks outside of their specialty, such as plastic surgeons performing preventive foot care (72%). Among allied health professionals, clinical engineering technologists performed more vascular assessments ($p < 0.001$), and half were engaged in wound management, preventive foot care, and self-foot care education. In conclusion, the type and proportion of health professionals in our study differed from those in countries with podiatrists, and many performed tasks outside their specialties. This is the first nationwide cross-sectional study of diabetic foot care in a country without podiatrists and is unique in examining multiple specialists/professionals in one study.

Outcomes of open reduction and internal fixation of calcaneus fractures: A database study comparing patients with and without diabetes

Johnson, M., Conover, B., **Frykberg, R.**, Raspovic, K., **Lavery, L.**, & Wukich, D.

Treatment of calcaneal fractures in patients with diabetes mellitus (DM) is challenging. The purpose of this study was to compare post-operative outcomes after open reduction and internal fixation (ORIF) for calcaneus fracture in patients with complicated DM, uncomplicated DM, and patients without DM. A commercially available de-identified database was queried for all calcaneus fracture diagnoses undergoing ORIF from 2010 to 2021. The patients were separated into three groups for analysis: patients without DM (10,951, 82.6%), uncomplicated DM (1,500, 11.3%) and complicated DM (802, 6.1%). At 1 year, post-operative adverse events were assessed among the three groups. The odds of adverse event(s) for each group were compared between the three groups with and without characteristic matching. In the unmatched cohorts, patients with complicated DM, when compared with patients without DM and patients with uncomplicated DM, had significantly higher rates of all adverse events with exception of DVT. Rates of CNA were significantly higher in patients with complicated DM compared with no DM (OR 107.7 (CI 24.83-467.6) $p < 0.0001$) and uncomplicated DM (OR 44.26 (CI 3.86-507.93) $p = 0.0002$). After matching, non-union, AKI, sepsis, surgical site infection, and wound disruption were higher in patients with complicated DM compared with patients without DM. There were no significant differences in the three groups with regard to reoperation, DVT, MI, pneumonia, or below the knee amputation. Patients with DM who underwent ORIF for calcaneus fracture experienced higher rates of post-operative adverse events compared with those patients without DM.

Footwear fit as a causal factor in diabetes-related foot ulceration: A systematic review

Jones, P., Armstrong, D., **Frykberg, R.,** Davies, M., & Rowlands, A.

Aims: Incorrectly fitting footwear (IFF) poses a risk of trauma to at-risk feet with diabetes. The aim of this systematic review was to summarise and assess the evidence that IFF is a statistically significant cause of ulceration.

Methods: We searched PubMed, Scopus, Web of Science and Google Scholar for English-language peer-reviewed studies reporting the number or percentage of people with diabetes-related foot ulceration (DFU) attributed to wearing IFF and included a physical examination of the footwear worn. Two independent reviewers assessed the risk of bias using the Newcastle-Ottawa scale.

Results: 4318 results were retrieved excluding duplicates with 45 studies shortlisted. Ten studies met the inclusion criteria with most rated as fair (n = 6) or good (n = 3). There is some evidence that DFU is significantly associated with IFF, but this is limited: only 3 of 10 included studies found a statistically significant percentage of those with DFU were wearing IFF or inappropriate footwear which included fastening, material, type or fit (15.0%-93.3%). Risk of bias in these three studies ranged from 'fair' to 'poor'. IFF definitions were often unreported or heterogeneous. Only one study reported IFF-related ulcer sites: 70% were at plantar hallux/toes and 10% at plantar metatarsal heads.

Conclusions: There is some evidence that IFF is a cause of DFU, but further research is needed, which defines IFF, and methodically records footwear assessment, ulcer location and physical activity. Researchers need to uncover why IFF is worn and if this is due to economic factors, a need for footwear education or other reasons.

Stellarex Drug-Coated Balloon for the Treatment of Peripheral Artery Disease: Five-Year Results from the ILLUMENATE Pivotal Randomized Controlled Trial

Krishnan, P., Faries, P., Niazi, K., Sachar, R., Jain, A., Brodmann, M., Werner, M., Holden, A., **Tarricone, A.,** Tarra, T., & Lyden, S.

This study aimed to report the 5-year outcomes from the ILLUMENATE Pivotal randomized controlled trial of the lower dose (2 µg/mm2) Stellarex drug-coated balloon (DCB) (Philips, formerly Spectranetics Corp, Colorado Springs, Colorado) compared with percutaneous transluminal angioplasty (PTA) for the treatment of symptomatic peripheral arterial disease. Long-term safety and effectiveness data for DCBs remains limited. The ILLUMENATE Pivotal was a prospective, randomized, multi-center, single-blinded study. Patients (Rutherford Clinical Category 2 to 4) were randomized 2:1 to Stellarex DCB or PTA. Follow-up was through 60 months. In total, 300 patients were enrolled. The mean age was 68.8 ± 10.2 years. At 60 months, freedom from a primary safety event was 69.2% in the Stellarex DCB arm and 68.2% in the PTA arm (log-rank, p = 0.623). The cumulative rate of major adverse events was 41.0% compared with 44.6% (p = 0.597), respectively. Freedom from clinically-driven target lesion revascularization (CD-TLR) was 70.3% in the Stellarex DCB arm compared with 68.2% in the PTA arm (p = 0.505). Time to first CD-TLR was 768.3 ± 478.9 days compared with 613.5 ± 453.4 days, respectively (p = 0.161). Kaplan-Meier estimates of freedom from all-cause mortality were 80.1% in the Stellarex DCB arm and 80.2% in the PTA arm (log-rank, p = 0.980). In conclusion, the 5-year results of the ILLUMENATE Pivotal randomized

controlled trial add to the consistent safety data from the broader ILLUMENATE clinical program. These are the first data to report the 5-year safety and efficacy of a lower dose (2 μg/mm2) DCB for the treatment of symptomatic peripheral arterial disease.

Methicillin-resistant Staphylococcus aureus in diabetic and non-diabetic foot infections

Lavery, L., Reyes, M., Suludere, M., Najafi, B., Sideman, M., Siah, M., & **Tarricone, A.**

To identify the incidence of methicillin-resistant Staphylococcus aureus (MRSA) infection, reinfection and clinical outcomes. Four hundred forty-six patients that were admitted to the hospital with moderate or severe foot infections were retrospectively reviewed. Tissue and bone cultures were obtained from the index hospital admission. Conversion was defined as methicillin susceptible Staphylococcus aureus in the first culture and subsequently MRSA when there was a reinfection. The incidence of MRSA was 7.8% (n = 35), with no significant difference between soft tissue infections (7.7%) and osteomyelitis (8.0%). MRSA incidence was 9.4 times higher in non-diabetics (23.8% vs. 3.2%, p = <0.01). The incidence of reinfection was 40.8% (n = 182). Conversion to MRSA was seen in 2.2% (n = 4) total, occurring in 5.4%. Non-diabetics were 20.1 times more likely to have MRSA reinfection than people with diabetes (28.6% vs. 1.9%, p < 0.001). MRSA patients had a higher proportion of healed wounds (82.4% vs. 69.3%, p = 0.02). There were no differences in other clinical outcomes in MRSA vs. other infections in reinfection (28.6% vs. 24.3%, p = 0.11), amputation (48.6% vs. 52.0%, p = 0.69) or hospitalization (28.6% vs. 42.6, p = 0.11). The incidence of MRSA for the first infection (7.8%), reinfection (6.0%) and conversion to MRSA (2.2%) was low. MRSA was 9.4 times more common in people without diabetes.

Randomized Clinical Trial to Compare Cryopreserved and Lyopreserved Umbilical Cord Tissue to Treat Complex Diabetic Foot Wounds

Lavery, L., Suludere, M., Johnson, M., Killeen, A., Raspovic, K., Crisologo, P., & **Tarricone, A.**

To compare the incidence of infection, wound closure and time to wound closure in patients treated with cryopreserved (CPUT) and lyopreserved umbilical tissue (LPUT) in complex diabetic surgical wounds. This single-blinded 12-week randomized clinical trial compared cryopreserved and lyopreserved amniotic cord tissue to treat complex diabetic foot wounds. LPUT or CRAT was applied at baseline and again after four weeks. We enrolled subjects with UT2A-D and 3A-D wounds (depth to tendon, muscle, or bone with infection and/or PAD) and excluded subjects with ABI < 0.5 or TBI < 0.3, untreated osteomyelitis, and autoimmune diseases. We used a 3-D camera to evaluate wound area and volume. The mean baseline wound areas were 12.9 ± 10.7 cm2 for CPUT and 11.7 ± 7.0 cm2 for LPUT. The mean baseline wound volume was 7.5 ± 8.1 for CPUT and 9.2 ± 10.2 cm3 for LPUT. There was no difference between CPUT and LPUT in wound closure (36.8% vs 19.0%, P = .21) or infection (10.5% vs 4.8%, P = .60). There was no difference in mean wound area reduction between CPUT and LPUT (75.9 ± 32.3% vs 65.5 ± 38.4%, P = .41), nor in mean volume reduction (85.0 ± 30.8% vs 79.9 ± 31.9%, P = .61). In addition, there was no difference in wound closure trajectories for changes in area (P = .75) or volume (P = .43). Cryopreserved and lyopreserved amniotic tissue provided similar results in patients with complex diabetic foot wounds.

The infected diabetic foot: Analysis of diabetic and non-diabetic foot infections

Lavery, L., Suludere, M., Ryan, E., Crisologo, P., **Tarricone, A.**, Malone, M., & Oz, O.

The aim of this study was to compare outcomes of moderate and severe foot infections in people with and without diabetes mellitus (DM). We retrospectively evaluated 382 patients (77% with DM and 23% non-DM). We collected demographic data, co-morbidities and one-year outcomes including healing, surgical interventions, number of surgeries, length of stay, re-infection and re-hospitalisation. DM patients required more surgeries (2.3 ± 2.2 vs. 1.7 ± 1.3, p = 0.01), but did not have a longer hospital length of stay during the index hospitalisation (DM 10.9 days ±9.2 vs. non-DM = 8.8 days ±5.8, p = 0.43). After the index hospitalisation, DM patients had increased rates of re-hospitalisation for any reason (63.3% vs. 35.2%, CI 1.9-5.2, OR 3.2, p < 0.01), re-infection at the index wound infection site (48% vs. 30.7%, CI 1.3-3.5, OR 2.1, p < 0.01), re-hospitalisation for a foot pathology (47.3% vs. 29.5%, CI 1.3-3.6, OR 2.1, p < 0.01), and longer times to ulcer healing (151.8 days ±108.8 vs. 108.8 ± 90.6 days, p = 0.04). Patients with DM admitted to hospital with foot infections have worse clinical outcomes during the index hospitalisation and are more likely to have re-infection and re-admission to hospital in the next year.

Does complete resection of infected bone improve clinical outcomes in patients with diabetic foot osteomyelitis?

Lavery, L., **Tarricone, A.**, Reyes, M., Suludere, M., Sideman, M., Siah, M., Peters, E., & Wukich, D.

The objective of the study was to compare outcomes in patients with complete surgical resection versus partial resection of diabetic foot osteomyelitis (OM). A post hoc analysis of 171 patients with OM was performed using data from two randomized clinical trials. OM was confirmed with bone culture or histopathology. Surgical culture specimens were obtained from resected bone and sent for histopathology and microbiology. Residual osteomyelitis (RO) was defined as a positive resected margin on culture or histopathology. No residual osteomyelitis (NRO) was defined as no growth from bone culture and no histopathological inflammation in the biopsy of the resection margin. Data from the 12-month follow-up were used to determine clinical outcomes. During the index hospitalization, NRO patients had significantly shorter duration of antibiotic therapy (NRO 21.0, 13.0-38.0 vs. RO 37.0, 20.8-50.0, p <0.01) and more amputations than patients with RO (NRO 89.9% vs. RO 60.9%, p <0.01). During the 12-month follow-up, patients with NRO also had significantly shorter duration of antibiotic therapy (NRO 42, 21.0-66.5 vs. RO 50.5, 35.0-75.0, p = 0.02). During the 12-month follow-up, there was no difference in ulceration at the same site (NRO 3.7%, RO 4.3% p = 0.85), hospitalization (NRO 32.6%, RO 34.8%, p = 0.76), total re-infections (NRO 25.3%, RO 29.3%, p = 0.56), re-infection with osteomyelitis (NRO 13.3% vs. 13.5%, p = 0.36), amputation (NRO 8.8%, RO 5.4%, p = 0.86) and time to wound healing in days (NRO 94, 41.0-365 vs. RO 106, 42.8-365, p = 0.77). Successful treatment of osteomyelitis was achieved by 86.7% and 86.5% of patients. During the index hospitalization, patients with no residual osteomyelitis had more amputations and were treated with antibiotics for a shorter duration. During the 12-month follow-up, patients with no residual osteomyelitis had shorter durations of antibiotics. There were no differences in re-infection, amputation, re-ulceration or hospitalization.

Re-infection after treatment for moderate and severe diabetic foot infections

Lavery, L., **Tarricone, A.**, Ryan, E., Crisologo, P., Malone, M., Suludere, M., **Rogers, L.**, & Wukich, D.

To investigate risk factors for re-infection and compare the outcomes in people with diabetic foot infections. A retrospective chart review was conducted, and 294 hospitalised patients with moderate to severe diabetic foot infections (DFIs) were analysed for this study. The diagnosis and classification of the severity of infection was based on the International Working Group on the Diabetic Foot (IWGDF) infection guidelines. Skin and soft tissue infections were diagnosed based on clinical observations as per IWGDF classification in addition to ruling out any suspected osteomyelitis (OM) through negative bone culture, MRI or WBC SPECT CT. OM was confirmed by bone culture or histopathology. Clinical outcomes were based on a 12-month follow-up period. All dichotomous outcomes were compared using $\chi 2$ with an alpha of 0.05. The result of this study shows a 48% rate of re-infection in people admitted to our hospital with moderate and severe diabetic foot infections (DFI). Patients with osteomyelitis present during the index admission were 2.1 times more likely to experience a re-infection than patients with soft tissue infection (56.7% vs. 38.0% respectively). In the univariate analysis, risk factors for re-infection included osteomyelitis, non-healing wounds, prolonged wound healing, antidepressants and leukocytosis. In the regression analysis, the only risk factor for re-infection was wounds that were not healed >90 days (HR =2.0, CI: 1.5, 2.7, p = 0.001). Re-infection is very common in patients with moderate and severe diabetic foot infections. Risk factors include osteomyelitis, non-healing wound, prolonged wound healing, antidepressants and leukocytosis.

Clinical outcomes in people with diabetes-related foot infections: Analysis from a limb preservation service infection database

Malone, M., Bergamin, E., Hayashi, K., Schwarzer, S., Dickson, H., Lau, N., **Lavery, L.**, & Commons, R.

Background: Diabetes-related foot infections are common and represent a significant clinical challenge. There are scant data about outcomes from large cohorts. The purpose of this study was to report clinical outcomes from a large cohort of people with diabetes-related foot infections.

Methods: A tertiary referral hospital limb preservation service database was established in 2018, and all new episodes of foot infections were captured prospectively using an electronic database (REDCap). People with foot infections between January 2018 and May 2023, for whom complete data were available on infection episodes, were included. Infection outcomes were compared between skin and soft tissue infections (SST-DFI) and osteomyelitis (OM) using chi-square tests.

Results: Data extraction identified 647 complete DFI episodes in 397 patients. The data set was divided into two cohorts identifying each infection episode and its severity as either SST-DFI (N = 326, 50%) or OM (N = 321, 50%). Most infection presentations were classified as being moderate (PEDIS 3 = 327, 51%), with 36% mild (PEDIS 2 = 239) and 13% severe (PEDIS 4 = 81). Infection resolution occurred in 69% (n = 449) of episodes with failure in 31% (n = 198). Infection failures were more common with OM than SST-DFI (OM = 140, 71% vs. SST-DFI = 58, 29%, p < 0.00001). In patients with SST-DFI a greater number of infection failures were observed in the presence of peripheral arterial disease (PAD) compared to the patients without PAD (failure occurred in 30% (31/103) of episodes with PAD and 12% (27/223) of episodes without PAD; p < 0.001). In contrast, the number of observed infection failures in OM episodes were similar in patients with and without PAD (failure occurred in 45% (57/128) of episodes with PAD

and 55% (83/193) of episodes without PAD; p = 0.78).

Conclusions: This study provides important epidemiological data on the risk of poor outcomes for DFI and factors associated with poor outcomes in an Australian setting. It highlights the association of PAD and treatment failure, reinforcing the need for early intervention to improve PAD in patients with DFI. Future randomised trials should assess the benefits of revascularisation and surgery in people with DFI and particularly those with OM where outcomes are worse.

Lower extremity amputation rates in patients with chronic kidney disease: A database study comparing patients with and without diabetes mellitus

Nandakumar, D., Johnson, M., **Lavery, L.**, Conover, B., Raspovic, K., Truong, D., & Wukich, D.

Lower extremity amputation (LEA) is one of the most feared consequences of diabetes mellitus (DM). The purpose of this study was to evaluate the impact of DM on LEA rates in patients at various stages of chronic kidney disease (CKD). A commercially available de-identified database was searched for patients undergoing LEA and for CKD patients, from 2010 to 2023. Patients with DM and patients without DM who were followed for at least 5 years were included. LEA rates were then compared for patients at all 5 CKD stages in patients with and without diabetes. Rates of all LEA were found to be significantly higher at all CKD stages for patients with diabetes (overall, minor and major LEA). Compared to patients without DM who have CKD stage 5 (end stage renal disease), patients with DM and CKD stage 5 have a 30 fold increased likelihood of undergoing overall LEA [OR 30.2 (24.48-37.19), p < 0.001], 29 fold increased likelihood of undergoing minor LEA [28.9i (22.91-36.35), p < 0.001] and 40 times fold increased likelihood of undergoing major LEA [40.1 (26.59-60.42), p < 0.001]. For all stages of CKD, independent of diabetes status, minor LEA were performed with greater frequency than major LEA. In patients with DM, LEA rates significantly increased with CKD progression between stages 2-5 with a substantial jump between stages 4 and 5 [OR 2.6 (CI 2.49-2.74), p < 0.001]. However, CKD progression between stages 1 and 2 was not significantly associated with increased LEA rates (OR 1.1 (CI 0.92-1.21), p = 0.24) in patients with diabetes. Patients with comorbid diabetes have elevated risk for LEA at all stages of CKD compared to those without diabetes.

Interventions in the management of diabetes-related foot infections: A systematic review

Peters, E., Albalawi, Z., van Asten, S., Abbas, Z., Allison, G., Aragón-Sánchez, J., Embil, J., **Lavery, L.**, Alhasan, M., Oz, O., Uçkay, I., Urbančič-Rovan, V., Xu, Z., & Senneville, É.

The optimal approaches to managing diabetic foot infections remain a challenge for clinicians. Despite an exponential rise in publications investigating different treatment strategies, the various agents studied generally produce comparable results, and high-quality data are scarce. In this systematic review, we searched the medical literature using the PubMed and Embase databases for published studies on the treatment of diabetic foot infections from 30 June 2018 to 30 June 2022. We combined this search with our previous literature search of a systematic review performed in 2020, in which the infection committee of the International Working Group on the Diabetic Foot searched the literature until June 2018. We defined the context of the literature by formulating clinical questions of interest, then developing structured clinical questions (Patients-Intervention-Control-Outcomes) to address these. We only included data from con-

trolled studies of an intervention to prevent or cure a diabetic foot infection. Two independent reviewers selected articles for inclusion and then assessed their relevant outcomes and methodological quality. Our literature search identified a total of 5,418 articles, of which we selected 32 for full-text review. Overall, the newly available studies we identified since 2018 do not significantly modify the body of the 2020 statements for the interventions in the management of diabetes-related foot infections. The recent data confirm that outcomes in patients treated with the different antibiotic regimens for both skin and soft tissue infection and osteomyelitis of the diabetes-related foot are broadly equivalent across studies, with a few exceptions (tigecycline not non-inferior to ertapenem [±vancomycin]). The newly available data suggest that antibiotic therapy following surgical debridement for moderate or severe infections could be reduced to 10 days and to 3 weeks for osteomyelitis following surgical debridement of bone. Similar outcomes were reported in studies comparing primarily surgical and predominantly antibiotic treatment strategies in selected patients with diabetic foot osteomyelitis. There is insufficient high-quality evidence to assess the effect of various recent adjunctive therapies, such as cold plasma for infected foot ulcers and bioactive glass for osteomyelitis. Our updated systematic review confirms a trend to a better quality of the most recent trials and the need for further well-designed trials to produce higher quality evidence to underpin our recommendations.

Residual diabetic foot osteomyelitis after surgery leads to poor clinical outcomes: A systematic review and meta-analysis

Reyes, M., Suludere, M., **Tarricone, A.**, Sajjad, T., Coye, T., Sideman, M., & **Lavery, L.**

The aim of this meta-analysis is to compare the clinical outcomes in patients with and without residual osteomyelitis (ROM) after surgical bone resection for diabetic foot osteomyelitis (DFO). We completed a systematic literature search using PubMed, Scopus, and Embase using keywords DFO, Residual OM (ROM), and positive bone margins. The study outcomes included wound healing, antibiotic duration, amputation, and re-infection. Five hundred and thirty patients were included in the analysis; 319 had no residual osteomyelitis (NROM), and 211 had ROM. There was not a significant difference in the proportion of wounds that healed 0.6 ($p = 0.1$, 95% confidence intervals [95% CI] 0.3-1.3). The risk of infection was 2.0 times higher (OR = 2.0, $p = 0.02$, 95% CI 1.1-3.4), and the risk of amputation was 4.3 times higher (OR = 4.3, $p = 0.0001$, 95% CI 2.4-7.6) in patients with ROM. Patients with ROM received antibiotics significantly longer. The mean difference was 16.3 days ($p = 0.02$, 95% CI 11.1-21.1).

Does the use of DACC-coated dressings improve clinical outcomes for hard to heal wounds: A systematic review

Schwarzer, S., Martinez, J., Killeen, A., Alves, P., Gledhill, A., Nygren, E., **Lavery, L.**, & Malone, M.

Reports of overuse and antimicrobial resistance have fuelled some clinicians to adopt alternative wound dressings termed to be non-medicated or non-antimicrobials, which still claim antimicrobial or antibacterial activity. In this PROSPERO-registered systematic review, we evaluated the in vivo clinical evidence for the effectiveness of DACC-coated dressings in chronic, hard to heal wound-related outcomes. The Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) Framework was adopted as the template in constructing this systematic review. The PICO format (Population [or patients], Intervention, Comparison [control], Outcome/s) was used to identify key clinical questions in determining

patient outcomes under two domains (infection control and wound healing). A systematic search was performed in PubMed, OVID, Cochrane Library, clinical trial registries and data sources from independent committees. Abstracts of all studies were screened independently by two reviewers, with six further reviewers independently assessing records proceeding to full review. The authors rated the quality of evidence for each of the outcomes critical to decision making. After excluding duplicates, 748 records were screened from the databases, and 13 records were sought for full review. After full review, we excluded a further three records, leaving ten records for data extraction. Three records were narrative reviews, three systematic reviews, two prospective non-comparative before/after studies, one prospective head-to-head comparator cohort study and one retrospective head-to-head comparator cohort study. No RCTs or case versus control studies were identified. The overall quality of clinical evidence for the use of DACC-coated dressing to improve wound infection and wound healing outcomes was assessed as very low. There is an urgent unmet need to perform appropriately designed RCTs or case-control studies. The extracted data provide no clarity and have limited to no evidence to support that using a DACC-coated dressing improves wound infection or wound healing outcomes. Further, there is no evidence to suggest this therapy is either superior to standard of wound care or equivocal to topical antimicrobial agents in the management of infected hard to heal wounds.

Diagnosis of infection in the foot of patients with diabetes: A systematic review

Senneville, É., Albalawi, Z., van Asten, S., Abbas, Z., Allison, G., Aragón-Sánchez, J., Embil, J., **Lavery, L.**, Alhasan, M., Oz, O., Uçkay, I., Urbančič-Rovan, V., Xu, Z., & Peters, E.

Background: Securing an early accurate diagnosis of diabetic foot infections and assessment of their severity are of paramount importance since these infections can cause great morbidity and potential mortality and present formidable challenges in surgical and antimicrobial treatment.

Methods: In June 2022, we searched the literature using PubMed and EMBASE for published studies on the diagnosis of diabetic foot infection (DFI). On the basis of pre-determined criteria, we reviewed prospective controlled, as well as non-controlled, studies in English. We then developed evidence statements based on the included papers.

Results: We selected a total of 64 papers that met our inclusion criteria. The certainty of the majority of the evidence statements was low because of the weak methodology of nearly all of the studies. The available data suggest that diagnosing diabetic foot infections on the basis of clinical signs and symptoms and classified according to the International Working Group of the Diabetic Foot/Infectious Diseases Society of America scheme correlates with the patient's likelihood of the need for hospitalisation, lower extremity amputation, and risk of death. Elevated levels of selected serum inflammatory markers such as erythrocyte sedimentation rate (ESR), C-reactive protein and procalcitonin are supportive, but not diagnostic, of soft tissue infection. Culturing tissue samples of soft tissues or bone, when care is taken to avoid contamination, provides more accurate microbiological information than culturing superficial (swab) samples. Although non-culture techniques, especially next-generation sequencing, are likely to identify more bacteria from tissue samples including bone than standard cultures, no studies have established a significant impact on the management of patients with DFIs. In patients with suspected diabetic foot osteomyelitis, the combination of a positive probe-to-bone test and elevated ESR supports this diagnosis. Plain X-ray remains the first-line imaging examination when there is suspicion of diabetic foot osteomyelitis (DFO), but advanced imaging methods including magnetic resonance imaging (MRI) and nuclear imaging when MRI is not feasible help in cases when either the diagnosis or the localisation of infection is uncertain. Intra-operative or non-per-wound percutaneous biopsy is the best method to accurately identify bone pathogens in case of a suspicion of a DFO. Bedside percutaneous biopsies are effective and safe and are an option

to obtain bone culture data when conventional (i.e. surgical or radiological) procedures are not feasible.

Conclusions: The results of this systematic review of the diagnosis of diabetic foot infections provide some guidance for clinicians, but there is still a need for more prospective controlled studies of high quality.

IWGDF/IDSA guidelines on the diagnosis and treatment of diabetes-related foot infections (IWGDF/IDSA 2023)

Senneville, É., Albalawi, Z., van Asten, S., Abbas, Z., Allison, G., Aragón-Sánchez, J., Embil, J., **Lavery, L.**, Alhasan, M., Oz, O., Uçkay, I., Urbančič-Rovan, V., Xu, Z., & Peters, E.

The International Working Group on the Diabetic Foot (IWGDF) has published evidence-based guidelines on the management and prevention of diabetes-related foot diseases since 1999. The present guideline is an update of the 2019 IWGDF guideline on the diagnosis and management of foot infections in persons with diabetes mellitus. The Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) framework was used for the development of this guideline. This was structured around identifying clinically relevant questions in the P(A)ICO format, determining patient-important outcomes, systematically reviewing the evidence, assessing the certainty of the evidence, and finally moving from evidence to the recommendation. This guideline was developed for healthcare professionals involved in diabetes-related foot care to inform clinical care around patient-important outcomes. Two systematic reviews from 2019 were updated to inform this guideline, and a total of 149 studies (62 new) meeting inclusion criteria were identified from the updated search and incorporated in this guideline. Updated recommendations are derived from these systematic reviews, and best practice statements made where evidence was not available. Evidence was weighed in light of benefits and harms to arrive at a recommendation. The certainty of the evidence for some recommendations was modified in this update with a more refined application of the GRADE framework centred around patient important outcomes. This is highlighted in the rationale section of this update. A note is also made where the newly identified evidence did not alter the strength or certainty of evidence for previous recommendations. The recommendations presented here continue to cover various aspects of diagnosing soft tissue and bone infections, including the classification scheme for diagnosing infection and its severity. Guidance on how to collect microbiological samples, and how to process them to identify causative pathogens, is also outlined. Finally, we present the approach to treating foot infections in persons with diabetes, including selecting appropriate empiric and definitive antimicrobial therapy for soft tissue and bone infections; when and how to approach surgical treatment; and which adjunctive treatments may or may not affect the infectious outcomes of diabetes-related foot problems. We believe that following these recommendations will help healthcare professionals provide better care for persons with diabetes and foot infections, prevent the number of foot and limb amputations, and reduce the patient and healthcare burden of diabetes-related foot disease.

Bromelain-based enzymatic debridement of venous leg ulcers versus gel vehicle (placebo) and non-surgical standard of care: a three-arm multicenter, double blinded, randomized controlled study

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Dhillon, Y., Cuffy, C., Egozi, D., . . . Rosenberg, L.

Background: Debridement is considered the first step in treatment of chronic wounds, however, current enzymatic and autolytic debridement agents are slow or ineffective. Previous studies have shown positive initial results with EscharEx® (EX-02 formulation), a Bromelain-based enzymatic debridement agent in development for chronic wounds. The main objective of this study was to assess its efficacy in debriding venous leg ulcers (VLU), compared to gel vehicle (GV) as a placebo control and to non-surgical standard of care (NSSOC).

Methods: A prospective, randomized, multicenter, placebo-controlled trial in patients with VLU from 20 medical centers and clinics in the United States, Switzerland and Israel was undertaken. Patients were treated with daily topical applications of either EX-02, GV, or NSSOC (in a 3:3:2 ratio), until reaching complete debridement or up to 8 daily treatments (within 2 weeks), and then followed-up for up to 14 weeks. The primary efficacy endpoint was the incidence of complete debridement. This study is registered with ClinicalTrials.gov (NCT03588130) and EudraCT (number 2020-004861-38).

Findings: A total of 196 patients were enrolled, and 119 randomized (between November 12th, 2019, and February 15th, 2022); 46 to the EX-02 arm, 43 to the GV arm, and 30 to the NSSOC arm. Eight patients dropped out of the study (2 in EX-02, 2 in GV, 4 in NSSOC). The incidence of complete debridement within 8 daily treatments was 63% (29/46 patients) in the EX-02 arm as compared to 30.2% (13/43 patients) in the GV arm ($p = 0.004$) and 13.3% (4/30 patients) in the NSSOC arm ($p < 0.001$). Sixty-five patients reported wound related adverse events throughout the study; 24 (52.2%), 27 (62.8%) and 14 (46.7%) patients in the EX-02, GV and NSSOC arms (p = NS). No deaths occurred during the study.

Interpretation: EX-02 lead to a significantly higher incidence of complete debridement as compared to GV and NSSOC, without significant safety issues. Additional studies are needed to explore the benefits of EX-02 in VLU and other chronic wound etiologies.

Development of a Core Outcome Set for Studies Assessing Interventions for Diabetes-Related Foot Ulceration

Staniszewska, A., Game, F., Nixon, J., Russell, D., Armstrong, D., Ashmore, C., Bus, S., Chung, J., Chuter, V., Dhatariya, K., Dovell, G., Edmonds, M., Fitridge, R., Gooday, C., Hamilton, E., Jones, A., Kavarthapu, V., **Lavery, L.**, Mills, J., Monteiro-Soares, M., Osborne-Grinter, M., Peters, E., Shalhoub, J., van Netten, J., Wukich, D., & Hinchliffe, R.

Objective: Diabetes affects 537 million people globally, with 34% expected to develop foot ulceration in their lifetime. Diabetes-related foot ulceration causes strain on health care systems worldwide, necessitating provision of high-quality evidence to guide their management. Given heterogeneity of reported outcomes, a core outcome set (COS) was developed to standardize outcome measures in studies assessing treatments for diabetes-related foot ulceration.

Research design and methods: The COS was developed using Core Outcome Measures in Effectiveness Trials (COMET) methodology. A systematic review and patient interviews generated a long list of outcomes that were rated by patients and experts using a nine-point Likert scale (from 1 [not important] to 9 [critical]) in the first round of the Delphi survey. Based on predefined criteria, outcomes without consensus were reprioritized in a second Delphi round. Critical outcomes and those without consensus after two Delphi rounds were discussed in the consensus meeting where the COS was ratified.

Results: The systematic review and patient interviews generated 103 candidate outcomes. The two consecutive Delphi rounds were completed by 336 and 176 respondents, resulting in an overall second round

response rate of 52%. Of 37 outcomes discussed in the consensus meeting (22 critical and 15 without consensus after the second round), 8 formed the COS: wound healing, time to healing, new/recurrent ulceration, infection, major amputation, minor amputation, health-related quality of life, and mortality.

Conclusions: The proposed COS for studies assessing treatments for diabetes-related foot ulceration was developed using COMET methodology. Its adoption by the research community will facilitate assessment of comparative effectiveness of current and evolving interventions.

The Infected Diabetic Foot: Does Negative Pressure Wound Therapy with Irrigation Reduce Bioburden and Improve Wound Healing?

Suludere, M., Malone, M., Siah, M., **Tarricone, A.**, Coye, T., Najafi, B., & **Lavery, L.**

The aim of this study was to compare the microbial loads of patients with diabetic foot infections treated with negative pressure wound therapy (NPWT) with and without irrigation with polyhexamethylene biguanide (NPWTi-P). This is a post hoc analysis of combined data of two randomized clinical trials. We evaluated people with diabetes treated with moderate and severe diabetic foot infections that required surgery. Tissue specimens were obtained after the initial surgery and following a second planned return to the operating room after 48-72 h of NPWT or NPWTi-P, prior to the second surgery. We used quantitative polymerase chain reaction (qPCR) to determine the total microbial loads (Log10 16S copies per gram of tissue). There was no difference in mean quantitative bacterial cultures among patients that received NPWT and NPWTi-P (before first surgery Log10: NPWT = 6.4 ± 1.8, NPWTi-P = 7.5 ± 1.7 vs before second surgery Log10: NPWT = 6.7 ± 1.8, NPWTi-P = 7.6 ± 1.9 p = .12). There was no difference in wound healing (59.5% vs 50.0%, p = .51) or time to heal (127 ± 109.3 vs 143 ± 95.9), p = .71). There were fewer re-infections in people that received traditional NPWT (28.6% vs 56.3%, p = .05).

MRSA infection, re-infection and clinical outcomes in diabetic foot infections

Suludere, M., Öz, O., **Rogers, L.**, Wukich, D., Malone, M., & **Lavery, L.**

The aim was to investigate methicillin-resistant Staphylococcus aureus (MRSA) incidence, conversion and outcomes in diabetic foot infections (DFIs). This is a pooled patient-level analysis of combined data sets from two randomised clinical trials including 219 patients admitted to the hospital with moderate or severe DFIs. Intraoperative bone and tissue cultures identified bacterial pathogens. We identified pathogens at index infections and subsequent re-infections. We identified MRSA conversion (MSSA to MRSA) in re-infections. MRSA incidence in index infections was 10.5%, with no difference between soft tissue infections (STIs) and osteomyelitis (OM). MRSA conversion occurred in 7.7% of the re-infections in patients who initially had MSSA in their cultures. Patients with re-infection were 2.2 times more likely to have MRSA compared to the first infection (10.5% vs. 25.8%, relative risk [RR] = 2.2, p = 0.001). Patients with MRSA had longer antibiotic treatment during the 1-year follow-up, compared to other pathogens (other 49.8 ± 34.7 days, MRSA 65.3 ± 41.5 days, p = 0.04). Furthermore, there were no differences in healing, time to heal, length of stay, re-infection, amputation, re-ulceration, re-admission, surgery after discharge and amputation after discharge compared to other pathogens. The incidence of MRSA at the index was 10.5% with no difference in STI and OM. MRSA incidence was 25.8% in re-infections. The

RR of having MRSA was 2.2 times higher in re-infections. Patients with MRSA used more antibiotics during the 1-year follow-up. Furthermore, there were no differences in clinical outcomes compared to other bacterial pathogens.

Near-infrared spectroscopy data for foot skin oxygen saturation in healthy subjects

Suludere, M., **Tarricone, A.,** Najafi, B., **Rogers, L**., Siah, M., Kang, G., & **Lavery, L.**

Our objective was to evaluate normative data for near-infrared spectroscopy (NIRS) in 110 healthy volunteers by Fitzpatrick skin type (FST) and region of the foot. We obtained measurements of the dorsum and plantar foot using a commercially available device (SnapshotNIR, Kent Imaging, Calgary Canada). On the dorsum of the foot, people with FST6 had significantly lower oxygen saturation compared to FST1-5 ($p < 0.001$), lower oxyhaemoglobin compared to FST2-5 ($p = 0.001$), but there was no difference in deoxyhaemoglobin. No differences were found on the plantar foot. When comparing dorsal and plantar foot, there was higher oxyhaemoglobin (0.40 ± 0.09 vs. 0.51 ± 0.12, $p < 0.001$) and deoxyhaemoglobin (0.16 ± 0.05 vs. 0.21 ± 0.05, $p < 0.001$) on the plantar foot, but no differences in oxygen saturation (dorsal 70.7 ± 10.8, plantar 70.0 ± 9.5, $p = 0.414$). In 6.4% of feet, there were black areas, for which no NIRS measurements could be generated. All areas with no data were on the dorsal foot and only found in FST 5-6. People with FST6 had significantly larger areas with no data compared to FST 5 ($22.2\ cm2 \pm 20.4$ vs. $1.9\ cm2 \pm 0.90$, $p = 0.007$). These findings should be considered when using NIRS technology. Skin pigmentation should be evaluated in future NIRS studies.

Uncontrolled Diabetes is a Strong Predictor of Amputation in End Stage Renal Disease Patients on Hemodialysis

Tarricone, A., Gee, A., Boulton, A., **Rogers, L.**, & **Lavery, L.**

Background: Diabetic nephropathy remains a strong risk factor for chronic kidney disease progression. Hemoglobin A1C (HBA1C) has historically been used as a marker for complications related to diabetes. The purpose of this study is to examine the relationship between HBA1C and clinical complications in a patient population with end stage renal disease.

Methods: This was a prospective study performed using patients from multiple outpatient dialysis centers in Texas, United States. All patients included patients must have end stage renal disease and were receiving either hemodialysis or peritoneal dialysis. An HBA1C $\geq 6.5\%$ was used as a cutoff to differentiate patients with well controlled versus uncontrolled diabetes in this population.

Results: HBA1C $\geq 6.5\%$ was strongly associated with both minor ($P = 0.0014$) and major ($P = 0.006$) amputation. Patients with HBA1C $\geq 6.5\%$ was associated with lower mortality compared to patients with HBA1C $< 6.5\%$, $P = 0.007$.

Conclusions: HBA1C remains a reliable marker for amputation in patients with end-stage renal disease; however, there is skepticism in using HBA1C as a marker for survival in these patients.

An Aggressively Recurrent Squamous Cell Carcinoma of the Foot

Tarricone, A., Gee, A., **De La Mata, K.,** Axman, W., Buricea, C., Trepal, M., & Krishnan, P.

Squamous cell carcinoma is a malignant tumor that is most commonly found on the head and neck. The current global incidence of squamous cell carcinoma at any site is estimated to be more than 1 million cases per year, with a reported 3-year mortality rate of 30%. Recurrence of squamous cell carcinoma at any site is estimated to be 15% to 50% and has been associated with greater rates of infiltration, perineural invasion, and mortality. Recent studies have shown lower-extremity squamous cell carcinoma to be distinct from squamous cell carcinoma at any site with histologic and clinical differences. Lower-extremity squamous cell carcinoma is suggestively less aggressive and carries less risk of metastasis. However, lower-extremity squamous cell carcinoma prevalence, mortality, and recurrence rates have not been extensively studied. The present report depicts a case of recurrent squamous cell carcinoma originating in 2006 in the dorsal forefoot and provides the clinical management of subsequent recurrence episodes, with excisions from 2015 and 2020.

Outcomes for Patients With Chronic Limb-Threatening Ischemia After Direct and Indirect Endovascular and Surgical Revascularization: A Meta-Analysis and Systematic Review

Tarricone, A., Gee, A., **De La Mata, K., Rogers, L.**, Wiley, J., **Lavery, L.,** & Krishnan, P.

Purpose: The purpose of this review and meta-analysis is to determine the clinical outcome differences between patients with chronic limb-threatening ischemia who underwent direct versus indirect angiosome revascularization using either the surgical or endovascular approach.

Materials and methods: The data sources used for article selection included PubMed, Embase/Medline, Cochrane reviews, and Web of Science (All studies were in English and included up to September 2023). All articles included were comparative in design, including retrospective, prospective, and randomized controlled trials that compared the clinical outcomes between direct and indirect angiosome-guided revascularization in chronic limb-threatening ischemia. A random-effects model was used to determine the measure of association between direct revascularization and amputation-free survival, wound healing, and overall survival. Publication bias was assessed with both Begg's and Egger's test, and heterogeneity was calculated using an I2.

Results: Data from 9 articles were analyzed and reported in this review. Direct revascularization was associated with improved amputation-free survival (odds ratio [OR]=2.632, confidence interval [CI]: 1.625, 4.265), binary wound healing (OR=2.262, CI: 1.518, 3.372), and overall survival (OR=1.757, CI: 1.176, 2.625). Time until wound healed was not associated with either direct or indirect revascularization (Standard Mean Difference [SMD]=-2.15, p=0.11). There was a low risk of bias across all studies according to the RoB 2.0 tool.

Conclusion: Direct revascularization is associated with improved amputation-free survival, overall survival, and wound healing in chronic limb-threatening ischemic patients compared to the indirect approach.

Clinical impact: Preservation of the lower extremity is critical for preventing mortality and maintaining independence. The benefit of angiosome-guided revascularization for chronic limb-threatening ischemia

remains controversial. The authors of this article aim to review the current literature and compare direct and indirect angiosome-guided intervention for preserving the lower extremity. Current findings suggest direct angiosome-guided intervention reduces amputation rates and improves survival; however, many trials neglect to address the multifactorial approach needed in wound care management.

Success of transmetatarsal amputation for limb salvage in patients with peripheral artery disease

Truong, D., Ngoo, A., Tsai, S., Yang, A., Wukich, D., & **Lavery, L.**

Limb salvage is a difficult path for patients to travel as there is no guarantee of the outcome, often the major factor is perfusion. For patients who underwent transmetatarsal amputation (TMA), success rate is crucial as the next option is most likely a major amputation. We performed a 10 years (2010-2020) retrospective review of patients that underwent a TMA and had an angiogram or computed tomography angiography (CTA) perioperatively at the Dallas VA Medical Center. Failure after TMA was defined as a patient requiring a proximal amputation within 1 year. There were 125 TMAs performed between 2010 and 2020 at the institution. Forty-four (35.2%) patients had an angiogram/CTA peri-operative and met the inclusion criteria. Seventeen subjects (38.6%) had a higher level of amputation. Of the 17 failures, 2 (11.8%) patients had no patent vessel runoff to the foot, 9 (52.9%) had one vessel, 4 (23.5%) had two vessels, and 2 (11.8%) had three vessels runoff. One vessel runoff to the foot yielded a high rate of poor outcomes (56.3%) defined as a higher level of amputation. Two or more vessels runoff to the foot had over 75% success of limb salvage with a TMA.

Prevention of foot ulcers in persons with diabetes at risk of ulceration: A systematic review and meta-analysis

van Netten, J., Raspovic, A., **Lavery, L.**, Monteiro-Soares, M., Paton, J., Rasmussen, A., Sacco, I., & Bus, S.

Aims: Prevention of foot ulcers in persons with diabetes is important to help reduce the substantial burden on both individual and health resources. A comprehensive analysis of reported interventions is needed to better inform healthcare professionals about effective prevention. The aim of this systematic review and meta-analysis is to assess the effectiveness of interventions to prevent foot ulcers in persons with diabetes who are at risk thereof.

Materials and methods: We searched the available scientific literature in PubMed, EMBASE, CINAHL, Cochrane databases and trial registries for original research studies on preventative interventions. Both controlled and non-controlled studies were eligible for selection. Two independent reviewers assessed risk of bias of controlled studies and extracted data. A meta-analysis (using Mantel-Haenszel's statistical method and random effect models) was done when >1 RCT was available that met our criteria. Evidence statements, including the certainty of evidence, were formulated according to GRADE.

Results: From the 19,349 records screened, 40 controlled studies (of which 33 were Randomised Controlled Trials [RCTs]) and 103 non-controlled studies were included. We found moderate certainty evidence that temperature monitoring (5 RCTs; risk ratio [RR]: 0.51; 95% CI: 0.31-0.84) and pressure-optimised therapeutic footwear or insoles (2 RCTs; RR: 0.62; 95% CI: 0.26-1.47) likely reduce the risk of plantar foot ulcer recurrence in people with diabetes at high risk. Further, we found low certainty evidence

that structured education (5 RCTs; RR: 0.66; 95% CI: 0.37-1.19), therapeutic footwear (3 RCTs; RR: 0.53; 95% CI: 0.24-1.17), flexor tenotomy (1 RCT, 7 non-controlled studies, no meta-analysis), and integrated care (3 RCTs; RR: 0.78; 95% CI: 0.58-1.06) may reduce the risk of foot ulceration in people with diabetes at risk for foot ulceration.

Conclusions: Various interventions for persons with diabetes at risk for foot ulceration with evidence of effectiveness are available, including temperature monitoring (pressure-optimised) therapeutic footwear, structured education, flexor tenotomy, and integrated foot care. With hardly any new intervention studies published in recent years, more effort to produce high-quality RCTs is urgently needed to further improve the evidence base. This is especially relevant for educational and psychological interventions, for integrated care approaches for persons at high risk of ulceration, and for interventions specifically targeting persons at low-to-moderate risk of ulceration.

Clinical and biomechanical effectiveness of foot-ankle exercise programs and weight-bearing activity in people with diabetes and neuropathy: A systematic review and meta-analysis

van Netten, J., Sacco, I., **Lavery, L.**, Monteiro-Soares, M., Paton, J., Rasmussen, A., Raspovic, A., & Bus, S.

Background: Most interventions to prevent foot ulcers in people with diabetes do not seek to reverse the foot abnormalities that led to the ulcer. Foot-ankle exercise programs target these clinical and biomechanical factors, such as protective sensation and mechanical stress. Multiple RCTs exist investigating the effectiveness of such programs, but these have never been summarised in a systematic review and meta-analysis.

Methods: We searched the available scientific literature in PubMed, EMBASE, CINAHL, Cochrane databases and trial registries for original research studies on foot-ankle exercise programs for people with diabetes at risk of foot ulceration. Both controlled and non-controlled studies were eligible for selection. Two independent reviewers assessed the risk of bias of controlled studies and extracted data. Meta-analysis (using Mantel-Haenszel's statistical method and random effect models) was performed when >2 RCTs were available that met our criteria. Evidence statements, including the certainty of evidence, were formulated according to GRADE.

Results: We included a total of 29 studies, of which 16 were RCTs. A foot-ankle exercise programme of 8-12 weeks duration for people at risk of foot ulceration results in: (a) no increase or decrease risk of foot ulceration or pre-ulcerative lesion (Risk Ratio (RR): 0.56 (95% CI: 0.20-1.57)); (b) no increase or decrease risk of adverse events (RR: 1.04 (95% CI: 0.65-1.67)); (c) not increase or decrease barefoot peak plantar pressure during walking (Mean Difference (MD): -6.28 kPa (95% CI: -69.90-57.34)); (d) no increase or decrease health-related quality of life (no meta-analysis possible). Likely results in increases in ankle joint and first metatarsalphalangeal joint range of motion (MD: 1.49° (95% CI: -0.28-3.26)) may result in improvements in neuropathy signs and symptoms (MD: -1.42 (95% CI: -2.95-0.12)), may result in a small increase in daily steps in some people (MD: 131 steps (95% CI: -492-754)), and may not increase or decrease foot and ankle muscle strength and function (no meta-analysis was possible).

Conclusions: In people at risk of foot ulceration, a foot-ankle exercise programme of 8-12 weeks duration may not prevent or cause diabetes-related foot ulceration. However, such a programme likely improves the ankle joint and first metatarsalphalangeal joint range of motion and neuropathy signs and symptoms.

Further research is needed to strengthen the evidence base, and should also focus on the effects of specific components of foot-ankle exercise programs.

Charcot neuroarthropathy in persons with diabetes: It's time for a paradigm shift in our thinking

Wukich, D., **Frykberg, R.,** & Kavarthapu, V.

The aim of this paper is to review the recent literature regarding the epidemiology and surgical management of Charcot neuro-osteoarthropathy (CNO). We propose that a fundamental change in the approach and assumptions regarding the historical treatment of active CNO should be considered. Although the true incidence and prevalence of CNO in the US population with diabetes are not known, we estimated the incidence to be 27,602 per year and the prevalence to be 208,880 persons. In persons with diabetes, the incidence of CNO is higher than that of prostate, lung, kidney, and thyroid cancer, and in the entire US population, the incidence of CNO is higher than that of multiple myeloma, soft tissue sarcoma, and primary bone sarcoma. In persons with diabetes, the incidence of CNO is higher than fractures of the femoral shaft, distal femur, tibia, talus, calcaneus and Lisfranc ligament injuries. Surgical techniques have evolved over the past half century, and surgery is the standard for treating displaced fractures and intra-articular injuries. Since CNO is a fracture, dislocation, or fracture dislocation in patients with neuropathy, why do we treat CNO differently? Elsewhere in the skeleton displaced osseous and ligament injuries are treated surgically. Based on the information presented in this manuscript, we suggest that it is time for a paradigm shift in the treatment of persons with CNO. While uncommon, CNO in persons with diabetes is not rare. Given the advances in surgical techniques, surgical intervention should be considered earlier in persons with CNO who are at risk for developing deformity related foot ulceration.

SHOULDER AND ELBOW

The greater tuberosity version angle: a novel method of acquiring humeral alignment during intramedullary nailing

Gutierrez-Naranjo, J., Salazar, L., Kanawade, V., Abdel Fatah, E., Mahfouz, M., Brady, N., & **Dutta, A.**

Aims: This study aims to describe a new method that may be used as a supplement to evaluate humeral rotational alignment during intramedullary nail (IMN) insertion using the profile of the perpendicular peak of the greater tuberosity and its relation to the transepicondylar axis. We called this angle the greater tuberosity version angle (GTVA).

Methods: This study analyzed 506 cadaveric humeri of adult patients. All humeri were CT scanned using 0.625 × 0.625 × 0.625 mm cubic voxels. The images acquired were used to generate 3D surface models of the humerus. Next, 3D landmarks were automatically calculated on each 3D bone using custom-written C++ software. The anatomical landmarks analyzed were the transepicondylar axis, the humerus anatomical axis, and the peak of the perpendicular axis of the greater tuberosity. Lastly, the angle between the transepicondylar axis and the greater tuberosity axis was calculated and defined as the GTVA.

Results: The value of GTVA was 20.9° (SD 4.7°) (95% CI 20.47° to 21.3°). Results of analysis of variance revealed that females had a statistically significant larger angle of 21.95° (SD 4.49°) compared to

males, which were found to be 20.49° (SD 4.8°) (p = 0.001).

Conclusion: This study identified a consistent relationship between palpable anatomical landmarks, enhancing IMN accuracy by utilizing 3D CT scans and replicating a 20.9° angle from the greater tuberosity to the transepicondylar axis. Using this angle as a secondary reference may help mitigate the complications associated with malrotation of the humerus following IMN. However, future trials are needed for clinical validation.

Muscle Compensation Strategies to Maintain Glenohumeral Joint Stability in Rotator Cuff Tears A Cadaveric Study

Hoshikawa, K., Dominguez, M., Lawrence, R., **Jacobs, P.**, Yuri, T., Mura, N., & Giambini, H.

Background: Superior translation of the humeral head is often identified in large and massive rotator cuff (RC) tears. However, the ability of the remaining RC muscles to compensate for the forces causing such superior translation in RC tears remains unclear. The purpose of this study was to investigate the impact of compensatory forces exerted by the remaining RC muscles on humeral head translation using a progressive RC tear model.

Methods: Eight fresh-frozen cadaveric shoulders (mean donor age, 57 years) were tested using a custom shoulder testing system. In addition to an intact RC model, 3 RC tear models were created: a supraspinatus tear (Tear I); combined supraspinatus and infraspinatus tears (Tear II); and combined tears of the supraspinatus, infraspinatus, and superior one-third of the subscapularis (Tear III). Compensatory conditions were simulated by increasing the loading of the remaining RC muscles in each RC tear model. Humeral head translation was measured at different abduction and neutral rotation angles in each condition with normal and high deltoid muscle loading.

Results: Significant superior translation of the humeral head was observed in Tears II and III (but not Tear I), compared with the intact state, under high loading of the deltoid during abduction and during rotation. In Tear II, compensatory conditions involving increased loading of the teres minor and subscapularis mus cles effectively reduced superior translation, so that no significant differences were observed compared with the intact state, even under high deltoid muscle loading. However, in Tear III, significant superior translation was still observed, regardless of the compensatory conditions.

Conclusions: compensation by the remaining RC muscles, particularly the teres minor and subscapularis, effectively reduced superior translation of the humeral head in the posterosuperior RC tear model, whereas this compensatory strategy was insufficient if tears also involved the superior one-third of the subscapularis.

Clinical relevance: Patients with posterosuperior RC tears may find conservative treatment focusing on strengthening the remaining RC muscles, especially the subscapularis and teres minor, to be beneficial. Conversely, patients with repairable massive RC tears also involving the subscapularis tendon may benefit from surgical interventions aimed at primarily repairing the subscapularis tendon to restore the transverse force couple. Massive tears deemed not to be repairable should be evaluated for arthroplasty or other procedures.

Quadruple Disruption of Superior Shoulder Suspensory Complex With Proximal Humerus Open Fracture-Dislocation: A Case Report

Quirarte, J., Wait, T., Jakkaraju, S., Smith, M., Salazar, L., Delbello, R., & **Dutta, A.**

Case: A 34-year-old man was a restrained passenger involved in a high-speed rollover motor vehicle crash. The patient sustained a type 5 AC joint separation, severely comminuted intra-articular glenoid fracture with extension to the coracoid process base, displaced open scapular body fracture, a posterior shoulder dislocation of the glenohumeral joint, and a 2-part proximal humerus fracture.

Conclusion: To our knowledge, this is the first report describing this injury pattern involving the superior shoulder suspensory complex with an associated open proximal humerus fracture-dislocation.

Three-dimensional measurement of humeral retroversion on a large academic cadaveric database

Valero-Moreno, E., Gutierrez-Naranjo, J., Appleton, M., Quirarte, J., Mahfouz, M., Abdel Fatah, E., & **Dutta, A.**

Background: The Humeral retroversion angle (HRA) has been described in the literature as the orientation of the humeral head compared with the epicondylar axis of the distal humerus. HRA is a crucial measurement for designing shoulder prostheses and surgical technique, and is often noted to range from 25° to 35° in healthy adults. However, a wide range of individual variability has been reported in literature, with reported values ranging from −6° to 74°. Various imaging modalities including X-rays, computed tomography scans, and magnetic resonance imaging have historically been used to measure this angle, but conventional 2-dimensional technologies may result in inaccuracy and variability in angular measurements. Therefore, recent studies have focused on using 3-dimensional (3D) modalities to measure HRA. These studies have shown promising results regarding accuracy and clinical significance, although most have only included a small number of subjects and have not procured conclusive findings. This study aims to measure the HRA in a large sample of subjects using 3D imaging to establish measurements for the general population.

Methods: We examined the right and left cadaveric humerus from 559 individuals (146 females and 413 males). All of the humeri underwent computed tomography scan and surface models generated. 3D landmarks were automatically calculated on each 3D bone using custom-written software in C++. Those landmarks were used to calculate (1) HRA as the angle between the epicondylar axis and the humeral neck axis and (2) humeral proximal neck angle (HPNA) as the angle between the humeral neck axis and the anatomical axis. Descriptive statistics of both HRA and HPNA was analyzed using JMP Pro statistical software version 15.2.0.

Results: The HPNA was found to be 137.7° ± 1.04° for males and 136.34° ± 1.4° for females with a 95% confidence interval. HRA was found to be 39.89° ± 12.77° for males and 38.89° ± 3.15° for females with a 95% confidence interval. Results of analysis of variance revealed that males had a statistically significant larger HRA than females ($P < .001$).

Conclusion: Our study suggests using a standardized measurement for the HRA, which we believe may improve operative outcomes. However, future prospective trials are required to validate our results in a clinical setting.

Quantifying the Positional Deviation Between the True Flexion-Extension and Epicondylar Axes of the Elbow: A 3D Computational Study

Zhi-Wei Gan, J., Pareatumbee, P., Yew, A., Tan, Z., Thong Siang Koh, D., Howe, T., Koh, S., **Morrey, B.,** & Ng, Y.

Background and objective: The epicondyles are commonly used surgical reference landmarks for elbow arthroplasty and external fixator application. This study aimed to investigate whether the epicondylar axis differed from the elbow's true flexion-extension (F-E) axis in terms of both rotational difference and translational offset.

Methods: Three-dimensional (3D) models of 15 cadaver elbows were created. The epicondylar, true F-E, and distal humeral axes were defined using the medial and lateral epicondyles and the normal vector through the trochlear groove's center respectively. Rotational difference along internal-external, varus-valgus, and flexion-extension rotation plane and translational offset in the anterior-posterior (A-P), medial-lateral (M-L), and inferior-superior (I-F) direction with reference to the distal humerus's long axis were measured.

Results: Minimal rotational differences of 1.9 ± 4.5, 2.1 ± 3.4, and 0.5 ± 2.7 degrees for flexion-extension, varus-valgus, and internal-external rotation were obtained respectively. Considerable translational offsets greater than 10 mm were found for the absolute medial and lateral translational offset with a statistically significant difference recorded in the M-L direction.

Conclusions: Small rotational differences exist between the epicondylar and true F-E axes. Significant differences are observed in the translational offset in the M-L direction and should be considered during implant alignment in order to reduce malalignment and prevent failure.

SPINE

The impact of depression in anterior cervical discectomy and fusion

Emukah, C., **Chaput, C.**, Singh, A., Kotzur, T., & Peng, L.

BACKGROUND CONTEXT: A number of studies have identified the presence of depression as a factor influencing perioperative and long-term surgical outcomes. Most of these studies suggest worse functional outcomes, increased length of stay and increased incidence of postoperative complications with patients with depression. To our knowledge, there has not been a study assessing the perioperative outcomes in patients who have undergone anterior cervical discectomy and fusion. Having a better understanding of the preoperative predictors of perioperative outcomes will improve patient selection for ACDF and enable targeted strategies for patients at higher risk for worse outcomes.

PURPOSE: This study is to assess perioperative outcomes associated with depression in the setting of anterior discectomy and fusion (ACDF) surgery.

STUDY DESIGN/SETTING: Retrospective study.

PATIENT SAMPLE: National Re-Admission Database.

OUTCOME MEASURES: Multivariate regression was performed to compare postoperative outcomes. Negative binomial regression was performed to assess 30-day readmissions and reoperations.

METHODS: This was a retrospective cohort study. The National Readmissions Database, years 2016-2019 was queried via ICD-10 code for patients, both with and without a diagnosis of depression, undergoing ACDF. Multivariate regression was performed to compare postoperative outcomes. Negative binomial regression was performed to assess 30-day readmissions and reoperations. Patient demographics and comorbidities, measured via the Elixhauser comorbidity index, were both controlled for in our regression analysis.

RESULTS: A total of 173,904 patients undergoing ACDF, 31,757 (18.26%) with a diagnosis of depression, were included in our analysis. Depression was associated with increased odds of medical (Odds Ratio (OR) 1.142; $p<0.001$) and surgical complications (OR 1.35; $p<0.001$), including postoperative infections (OR 2.545; $p<0.001$). Patients with depression were also more likely to require readmission (OR 1.78; $p<0.001$) and reoperation (OR 2.365; $p<0.001$).

CONCLUSIONS: Depression is common in patients undergoing ACDF, with over 18% of patients in our cohort having a formal diagnosis. These patients are at increased risk of complications, both medical and surgical, and have greater odds of readmission and reoperation. Surgeons should be aware of depression in their patients and educate their patients with depression that this diagnosis is associated with a number of poor outcomes. FDA Device/Drug Status: This abstract does not discuss or include any applicable devices or drugs.

The T4-L1-Hip Axis: Sagittal Spinal Realignment Targets in Long-Construct Adult Spinal Deformity Surgery: Early Impact

Hills, J., Mundis, G., Klineberg, E., Smith, J., Line, B., Gum, J., Protopsaltis, T., Hamilton, D., Soroceanu, A., Eastlack, R., Nunley, P., Kebaish, K., Lenke, L., Hostin, R., Jr., Gupta, M., Kim, H., Ames, C., Burton, D., Shaffrey, C., . . . Kelly, M.

Background: Our understanding of the relationship between sagittal alignment and mechanical complications is evolving. In normal spines, the L1-pelvic angle (L1PA) accounts for the magnitude and distribution of lordosis and is strongly associated with pelvic incidence (PI), and the T4-pelvic angle (T4PA) is within 4° of the L1PA. We aimed to examine the clinical implications of realignment to a normal L1PA and T4-L1PA mismatch.

Methods: A prospective multicenter adult spinal deformity registry was queried for patients who underwent fixation from the T1-T5 region to the sacrum and had 2-year radiographic follow-up. Normal sagittal alignment was defined as previously described for normal spines: L1PA = PI × 0.5 - 21°, and T4-L1PA mismatch = 0°. Mechanical failure was defined as severe proximal junctional kyphosis (PJK), displaced rod fracture, or reoperation for junctional failure, pseudarthrosis, or rod fracture within 2 years. Multivariable nonlinear logistic regression was used to define target ranges for L1PA and T4-L1PA mismatch that minimized the risk of mechanical failure. The relationship between changes in T4PA and changes in global sagittal alignment according to the C2-pelvic angle (C2PA) was determined using linear regression. Lastly, multivariable regression was used to assess associations between initial postoperative C2PA and patient-reported outcomes at 1 year, adjusting for preoperative scores and age.

Results: The median age of the 247 included patients was 64 years (interquartile range, 57 to 69 years), and 202 (82%) were female. Deviation from a normal L1PA or T4-L1PA mismatch in either direction was

associated with a significantly higher risk of mechanical failure, independent of age. Risk was minimized with an L1PA of PI × 0.5 - (19° ± 2°) and T4-L1PA mismatch between -3° and +1°. Changes in T4PA and in C2PA at the time of final follow-up were strongly associated (r 2 = 0.96). Higher postoperative C2PA was independently associated with more disability, more pain, and worse self-image at 1 year.

Conclusions: We defined sagittal alignment targets using L1PA (relative to PI) and the T4-L1PA mismatch, which are both directly modifiable during surgery. In patients undergoing long fusion to the sacrum, realignment based on these targets may lead to fewer mechanical failures.

Diagnosis of spine pseudoarthrosis based on the biomechanical properties of bone

Hipp, J., Mikhael, M., Reitman, C., Buser, Z., Patel, V., **Chaput, C.**, Ghiselli, G., DeVine, J., Berven, S., Nunley, P., & Grieco, T.

Background: Cervical spine fusion, commonly performed with generally favorable outcomes, may result in postsurgical symptoms requiring further investigation and treatment. Anterior cervical discectomy and fusion (ACDF) aims to decompress neural structures, stabilize motion segments, eliminate intervertebral motion, and promote bridging bone formation. Failure to form bridging bone may result in persistent symptoms or symptomatic pseudoarthrosis. Traditional diagnosis involves computerized tomography to detect bridging bone and/or flexion-extension radiographs to assess whether segmental motion is above specific thresholds. This paper proposes a new biomechanically based diagnostic approach to address limitations in traditional diagnostic methods. The scientific basis of this approach is that bridging bone cannot occur if the strain is greater than the failure strain of the bone.

Methods: Fully automated methods were used to measure disc space strains. Errors in strain measurements were assessed from simulated radiographs. Measurement error combined with the reported failure strain of trabecular bone led to a proposed strain threshold for pseudoarthrosis diagnosis post-ACDF surgery. A reanalysis of previously reported flexion-extension radiographs for asymptomatic volunteers was used to assess whether flexion-extension radiographs, in the absence of fusion surgery, can be expected to provide sufficient stress on motion segments to allow for reliable strain-based fusion assessment. The sensitivity and specificity of strain- and rotation-based pseudoarthrosis diagnosis were assessed by reanalysis of previously reported post-ACDF flexion-extension radiographs, where intraoperative fusion assessments were also available. Finally, changes in strain over time were explored through the use of 9,869 flexion-extension radiographs obtained 6 weeks to 84 months post-ACDF surgery from 1,369 patients.

Results: The estimated error in measuring disc space strain from radiographs was approximately 3%, and the reported failure strain of bridging bone was less than 2.5%. On that basis, a 5% strain threshold is proposed for pseudoarthrosis diagnosis. Good-quality flexion-extension radiographs can be expected to stress the spine sufficiently to facilitate strain-based diagnosis of pseudoarthrosis. Reanalysis of a study in which intraoperative fusion assessments were available revealed 67% sensitivity and 82% specificity for strain-based diagnosis of pseudoarthrosis, which is comparable to rotation-based diagnosis. Analysis of post-ACDF flexion-extension radiographs revealed rapid strain reduction for up to 24 months, followed by a slower decrease for up to 84 months. When rotation is less than 2 degrees, the strain-based diagnosis differs from the rotation-based diagnosis in approximately 14% of the cases.

Discussion: Steps for standardizing strain-based diagnosis of pseudoarthrosis are proposed based on the failure strain of bone, measurement error, and retrospective data. These steps include obtaining high-quality flexion-extension studies, the application of proposed diagnostic thresholds, and the use of image stabilization for conclusive diagnosis, especially when motion is near thresholds. The necessity for an

accurate diagnosis with minimal radiation exposure underscores the need for further optimization and standardization in diagnosing pseudoarthrosis following ACDF surgery.

Navigating the complexity of spinal cord injuries with retained foreign bodies and the diagnostic challenge of lead toxicity-a case report

Koslosky, E., Oshoba, S., Armstrong, C., **Chaput, C.**, & Landrum, M.

Introduction: Retained shrapnel from gunshots is a common occurrence; however, retained shrapnel within the spinal canal is exceedingly uncommon. Guidelines for removal and treatment of these cases are a difficult topic, as surgical removal is not necessarily without consequence, and retention can lead to possible further injury or a secondary disease process of plumbism, which can be difficult to diagnose in this population.

Case presentation: This case report provides a unique example of a young patient with retained shrapnel from a gunshot. This patient suffered an initial spinal cord injury due to a gunshot and secondarily presented with abdominal pain, fatigue, elevated blood lead levels, and was diagnosed with plumbism. This was addressed with operative removal of shrapnel and posterior instrumented spinal fusion, resulting in decreased lead levels and symptom resolution postoperatively.

Discussion: Lead toxicity risk in patients with retained shrapnel, particularly in the spine, warrants vigilant monitoring. While management guidelines lack consensus, symptomatic lead toxicity may necessitate intervention. Residual neurological deficits complicate evaluation, emphasizing individualized management decisions.

Lumbopelvic fixation in the treatment of spinopelvic dissociation: union, complications, and neurologic outcomes of a multicenter case series

Moo Young, J., Savakus, J., Obey, M., Morris, C., Pereira, D., **Hills, J.**, McKane, A., Babcock, S., Miller, A., Mitchell, P., & Stephens, B.

Purpose: To review outcomes of spinopelvic dissociation treated with open lumbopelvic fixation.

Methods: We reviewed all cases of spinopelvic dissociation treated at three Level-I trauma centers with open lumbopelvic fixation, including those with adjunctive percutaneous fixation. We collected demographic data, associated injuries, pre- and postoperative neurologic status, pre- and postoperative kyphosis, and Roy-Camille classification. Outcomes included presence of union, reoperation rates, and complications involving hardware or wound.

Results: From an initial cohort of 260 patients with spinopelvic dissociation, forty patients fulfilled inclusion criteria with a median follow-up of 351 days. Ten patients (25%) had a combination of percutaneous iliosacral and open lumbopelvic repair. Average pre- and postoperative kyphosis was 30 degrees and 26 degrees, respectively. Twenty patients (50%) had neurologic deficit preoperatively, and eight (20%) were unknown or unable to be assessed. All patients presenting with bowel or bladder dysfunction (n = 12) underwent laminectomy at time of surgery, with 3 patients (25%) having continued dysfunction at final

follow-up. Surgical site infection occurred in four cases (10%) and wound complications in two (5%). All cases (100%) went on to union and five patients (13%) required hardware removal.

Conclusion: Open lumbopelvic fixation resulted in a high union rate in the treatment of spinopelvic dissociation. Approximately 1 in 6 patients had a wound complication, the majority of which were surgical site infections. Bowel and bladder dysfunction at presentation were common with the majority of cases resolving by final follow-up when spinopelvic dissociation had been treated with decompression and stable fixation.

Which sagittal plane assessment method is most predictive of complications after adult spinal deformity surgery?

Pizones, J., **Hills, J.**, Kelly, M., Yilgor, C., Moreno-Manzanaro, L., Perez-Grueso, F., Kleinstück, F., Obeid, I., Alanay, A., & Pellisé, F.

Purpose: Different methods of sagittal alignment assessment compete for predicting adverse events after adult spinal deformity (ASD) surgery. We wanted to study which method provides greater benefit.

Methods: Retrospective study of 391 patients operated for ASD, with > 6 instrumented levels, fused to the pelvis, and 2 years of follow-up. Three alignment methods were analyzed 6-week postoperatively: (1) Roussouly mismatch; (2) GAP score/GAP categories; (3) T4-L1-Hip axis. Binary logistic regression generated models that best predict the following adverse events: mechanical complications (MC): in general and isolated (PJK, PJF, rod breakage); re-interventions (in general and after MC); and readmissions. ROC/AUC analysis was also implemented. In a second regression round, we added different variables that were selected on univariate analysis-demographic, surgical, and radiographic-to complete the models.

Results: The best predictor parameters in most models were T4-L1PA mismatch and GAP score; we could not prove a predictive ability of the Roussouly mismatch. The T4-L1PA mismatch best predicted general MC, PJK, PJK + PJF, and readmission, while the GAP score best predicted PJF and re-interventions (for MC and for any complication). However, the variance explained by these models was limited (Nagelkerke's R2 = 0.031-0.113), with odds ratios ranging from 1.070 to 1.456. ROC curves plotted an AUC between 0.57 and 0.70. Introducing additional variables (demographic, surgical, and radiographic) improved prediction in all the models (Nagelkerke's R2 = 0.082-0.329) and allowed predicting rod breakage.

Conclusion: The T4-L1-Hip axis and GAP score show potential in predicting adverse events, surpassing the Roussouly method. Despite partial efficacy in complication anticipation, recognizing postoperative sagittal alignment as a key modifiable risk factor, the crucial need arises to integrate diverse variables, both modifiable and non-modifiable, for enhanced predictive accuracy.

A Geometrical Explanation for Change in Pelvic Tilt (or Lack of Change) Following Long Spinal Fusions

Prabhakar, G., Kelly, M., Koslosky, E., Eck, A., Emukah, C., **Chaput, C.**, & **Hills, J.**

Study design: Retrospective cohort.

Objective: Examine the relationship between compensatory pelvic retroversion, positive sagittal imbalance (measured by C2 tilt), and the C2 pelvic angle (C2PA) in patients before long spinal fusions; and to

determine the association between changes in C2PA and pelvic tilt (PT) following long spinal fusions.

Background: Adult spinal deformity surgical goals often include a PT target, yet patients frequently demonstrate persistent compensatory pelvic retroversion following surgery.

Methods: Adults above 18 years old undergoing long spinal fusions (>4 levels) with standing preoperative and postoperative radiographs were included. To examine drivers of preoperative sagittal balance, regression models were fit to estimate the association between preoperative C2PA and pelvic incidence with preoperative PT and C2 tilt. To predict postoperative change in PT, multivariable regression was used to estimate change in PT, adjusting for change in C2PA and preoperative C2 tilt.

Results: Among the 80 patients identified, the median age was 61 (IQR: 45-72) and 46 (58%) were female. The median number of levels fused was 10 (IQR: 8-13) and 55 (69%) were instrumented to the sacrum/pelvis. Preoperative C2PA had a significant nonlinear association with preoperative PT (r2 =0.81, P <0.001) and preoperative C2 tilt (r2 =0.41, P =0.002). Postoperative change in PT was strongly associated with change in C2PA (β=0.81; P <0.001) and preoperative C2 tilt (β=0.55; P <0.001).

Conclusions: Following long spinal fusions, change in PT (or lack thereof) can be reliably predicted based on change in C2PA and preoperative C2 tilt. In patients with normal preoperative C2 tilt, the change in C2PA is nearly equivalent to the change in PT, but in patients with more positive C2 tilt (sagittal imbalance), a greater change in C2PA will be required to achieve an equivalent change in PT.

Computer Assisted Navigation Does Not Improve Outcomes in Posterior Fusion for Adolescent Idiopathic Scoliosis

Singh, A., Kotzur, T., Peterson, B., Koslosky, E., Emukah, C., & **Chaput, C.**

Study design: Retrospective Cohort Study.

Objective: The aim of this study was to compare the efficacy of CT-based computer assisted navigation (CAN) to conventional pedicle screw placement for patients with Adolescent Idiopathic Scoliosis (AIS).

Methods: This retrospective cohort study drew data from the National Readmissions Database, years 2016-2019. Patients undergoing posterior fusion for AIS, either via CAN or fluoroscopic-guided procedures, were identified via ICD-10 codes. Multivariate regression was performed to compare outcomes between operative techniques. Negative binomial regression was used to asses discharge disposition, while Gamma regression was performed to assess length of stay (LOS) and total charges. Patient demographics and comorbidities, measured via the Elixhauser comorbidity index, were both controlled for in our regression analysis.

Results: 28,868 patients, 2095 (7.3%) undergoing a CAN procedure, were included in our analysis. Patients undergoing CAN procedures had increased surgical complications (Odds Ratio (OR) 2.23; P < 0.001), namely, blood transfusions (OR 2.47; P < 0.001). Discharge disposition and LOS were similar, as were reoperation and readmission rates; however, total charges were significantly greater in the CAN group (OR 1.37; P < 0.001). Mean charges were 191,489.42 (119,302.30) USD for conventional surgery vs 268 589.86 (105,636.78) USD for the CAN cohort.

Conclusion: CAN in posterior fusion for AIS does not appear to decrease postoperative complications and is associated with an increased need for blood transfusions. Given the much higher total cost of care that was also seen with CAN, this study calls into question whether the use of CAN is justified in this setting.

SPORTS MEDICINE

Maintaining Joy in Orthopaedic Practice

Deutsch, A., **Johnson, A**., Sargent, C., & Gregory, K.

Orthopaedic surgeons may, at times, derive less enjoyment from their work. Limited engagement can arise, on the one hand, from limited autonomy, burdens of care, and reduced reimbursement. On the other hand, surgeons may enjoy their work less if they feel less able to help people. For instance, people with pressing medical, mental, and social health opportunities may place inordinate hope on what an orthopaedic surgeon can do to improve their lives. Pressure to provide tests and treatment with more potential for harm than benefit can, at times, contribute to a sense of futility and emotional exhaustion. There may, at times, be small and large pressures that can induce surgeons to compromise respect for evidence and lapse in adherence to ethical principles, placing them at risk for moral injury. These aspects of orthopaedic practice seem important given the association between limited joy in practice and self-harm, abandoning medical practice, and errors and patient harm. There are things to consider when working on joy in practice, including recognizing and naming the unsavory parts of practice; making improvement in the area for creativity, innovation, and personal growth; and developing strategies to limit and alleviate stress.

Posttraumatic Amputations Epidemiology and Outcomes Within the National Trauma Data Bank Improved Survival Over Time Results in Increased Population in Need of Rehabilitation Support

Hergert, B., Rana, A., Velasquez, J., **Johnson, A.,** Ali, S., Wong, K., & Teixeira, P.

Objective: Acute trauma care has significantly reduced mortality over the last two decades. The last study to examine the epidemiology of traumatic amputees predates these gains. The majority of those who sustain traumatic amputation are male; therefore, limited data exist on female amputees. This study aimed to (1) provide a current epidemiological analysis of traumatic amputees and (2) compare male and female amputees.

Design: All patients sustaining a major limb amputation in the National Trauma Data Bank from 2013 to 2017 were identified. First, descriptive analyses of patient demographics and injury characteristics were performed and compared with a previous 2000-2004 National Trauma Data Bank study. Second, female and male traumatic amputees were compared in this study.

Results: From 2013 to 2017, we identified 7016 patients who underwent major limb amputation. Compared with previous years, the current amputees were older and more severely injured. Mortality was 6.3% in the current years compared with 13.4% in the previous years (odds ratio, 0.44, 95% CI = 0.37-0.51, P < 0.001). After multivariable analysis, mortality remained significantly decreased, with no difference in hospital length of stay.

Conclusions: Contemporary National Trauma Data Bank analysis demonstrated that patients with traumatic amputations, regardless of sex, often survive until hospital discharge, despite more severe injuries.

The Impact of Anterior Cruciate Ligament Tear on Player Performance and Longevity in La Liga League Soccer Players

Ghali, A., Ghobrial, P., Momtaz, D., Krishnakumar, H., Gonuguntla, R., Salem, Y., Alsaidi, A., Bartush, K., & **Heath, D.**

Anterior cruciate ligament (ACL) rupture is among the most studied sports injuries. We investigate the impact of ACL reconstruction (ACLR) on performance and longevity in La Liga to elucidate performance parameters impacted after surgery in professional soccer players and variables impacting return-to-play (RTP).Demographic and performance data for La Liga players with ACLR between 1993 and 2020 were collected three seasons before and after injury and compared with two healthy controls. Analysis was conducted between and within ACLR and control groups. Pearson's correlation coefficients and a multiple linear regression model analyzed relationships between demographic variables and RTP.After exclusion, 23 professional soccer players were identified for the ACLR group. One year after index, ACLR had lower goals, shots on-target, assists, pass percentage, tackles, tackle success percentage, blocks, and clearances compared with control ($p < 0.05$). Two years after index, ACLR had lower assists, pass percentage, and tackle success percentage than control ($p < 0.05$). Three years after index, ACLR had fewer matches and blocks versus control ($p < 0.05$). Pearson's correlation showed a positive correlation between experience and RTP ($p = 0.001$). Multiple linear regression found RTP to increase 32.66 days for each additional year of experience ($p < 0.001$).With performance metrics showing significant decreases up to 2 years post-ACLR but largely recovering within 3 years of RTP, results support that soccer players undergoing ACLR eventually recover to preinjury levels of play. Players should be counseled on initial declines in performance metrics the first few years after RTP.

Durability of intercalary endoprosthesis for humeral reconstruction

Labott, J., Heidenreich, M., Broida, S., **Mills, G.**, Rose, P., & Houdek, M.

Introduction: The humerus is a common site of metastases and primary tumors. For some patients with a segmental defect and/or diaphyseal cortical destruction a cemented intercalary device may provide a more reliable construct, however data on their use is limited.

Methods: We reviewed 43 (28 male and 15 female) patients treated with an intercalary humeral spacer at a single tertiary referral center between 1989 and 2022. Humeral lesions were most commonly secondary to metastatic disease (n = 29, 68%), with 25 (58%) patients presenting with a pathologic fracture. Mean age and body mass index were 66 years and 27.9 kg/m2 . First generation taper joint device were used in 22 patients and second-generation lap device in 21 patients.

Results: Following reconstruction the 2-year overall survival was 30%. Mechanical complications occurred in 11 patients, most commonly aseptic loosening (n = 6, 14%). With death as a competing risk, the cumulative incidence of mechanical failure was 28% at 2-years postoperative. Following the procedure, mean Musculoskeletal Tumor Society scores was 70% and mean shoulder elevation was 87°.

Conclusion: Reconstruction of the humeral diaphysis with an intercalary endoprosthesis provides restoration of function of the upper extremity, however, is associated with one in four patients having mechanical failure.

Long-term outcome of total hip arthroplasty in patients with multiple hereditary exostosis

Labott, J., Heidenreich, M., **Mills, G.**, Lewallen, D., Houdek, M., & Couch, C.

Background: Multiple hereditary exostosis (MHE) is a rare autosomal dominant disorder characterized by multiple osteochondromas. There is a paucity of literature concerning total hip arthroplasty (THA) in patients with MHE. The aim of this study is to report long-term outcomes of THA in patients with MHE.

Methods: Fourteen patients undergoing 15 THA's for the treatment of osteoarthritis in the presence of osteochondromas and proximal femoral deformity secondary to MHE were reviewed. Mean age at the time of surgery and follow-up was 56 and 12 years. Seven (47%) had uncemented femoral components. Eleven hips had coxa valga on preoperative imaging. Clinical outcomes were assessed with both Harris hip scores (HHS) and Musculoskeletal Tumor Society Scores (MSTS).

Results: Following surgery, there was an improvement in the HHS (48-82, $p < 0.01$) and MSTS scores (41-70%, $p < 0.01$). Complications occurred in 5 patients leading to reoperation in 3 patients, of which 2 patients underwent a revision procedure at 19 and 20-years postoperative. The 10-year revision free survival was 100%.

Conclusions: THA in the setting of MHE reliably improves patient function. One in three patients will have a postoperative complication; however, the long-term incidence of revision is low.

A Novel Machine Learning Model to Predict Revision ACL Reconstruction Failure in the MARS Cohort

MARS Group, Vasavada, K., Vasavada, V., Moran, J., Devana, S., Lee, C., Hame, S. L., Jazrawi, L., Sherman, O., Huston, L., Haas, A., Allen, C., Cooper, D., **DeBerardino, T.**, Spindler, K., Stuart, M., Ned Amendola, A., Annunziata, C., Arciero, R., Bach, B., Jr., … York, J.

Background: As machine learning becomes increasingly utilized in orthopaedic clinical research, the application of machine learning methodology to cohort data from the Multicenter ACL Revision Study (MARS) presents a valuable opportunity to translate data into patient-specific insights.

Purpose: To apply novel machine learning methodology to MARS cohort data to determine a predictive model of revision anterior cruciate ligament reconstruction (rACLR) graft failure and features most predictive of failure.

Study design: Cohort study; Level of evidence, 3.

Methods: The authors prospectively recruited patients undergoing rACLR from the MARS cohort and obtained preoperative radiographs, surgeon-reported intraoperative findings, and 2- and 6-year follow-up data on patient-reported outcomes, additional surgeries, and graft failure. Machine learning models including logistic regression (LR), XGBoost, gradient boosting (GB), random forest (RF), and a validated ensemble algorithm (AutoPrognosis) were built to predict graft failure by 6 years postoperatively. Validated performance metrics and feature importance measures were used to evaluate model performance.

Results: The cohort included 960 patients who completed 6-year follow-up, with 5.7% ($n = 55$) experiencing graft failure. AutoPrognosis demonstrated the highest discriminative power (model area under the receiver operating characteristic curve: AutoPrognosis, 0.703; RF, 0.618; GB, 0.660; XGBoost, 0.680; LR, 0.592), with well-calibrated scores (model Brier score: AutoPrognosis, 0.053; RF, 0.054; GB, 0.057;

XGBoost, 0.058; LR, 0.111). The most important features for AutoPrognosis model performance were prior compromised femoral and tibial tunnels (placement and size) and allograft graft type used in current rACLR.

Conclusion: The present study demonstrated the ability of the novel AutoPrognosis machine learning model to best predict the risk of graft failure in patients undergoing rACLR at 6 years postoperatively with moderate predictive ability. Femoral and tibial tunnel size and position in prior ACLR and allograft use in current rACLR were all risk factors for rACLR failure in the context of the AutoPrognosis model. This study describes a unique model that can be externally validated with larger data sets and contribute toward the creation of a robust rACLR bedside risk calculator in future studies.

Surgical Predictors of Clinical Outcome 6 Years After Revision ACL Reconstruction

MARS Group, Wright, R., Huston, L., Haas, A., Pennings, J., Allen, C., Cooper, D., **DeBerardino, T.**, Dunn, W., Lantz, B., Spindler, K., Stuart, M., Amendola, A., Annunziata, C., Arciero, R., Bach Jr., B., Baker, C., III, Bartolozzi, A., Baumgarten, K., Berg, J., . . . York, J.

Background: Revision anterior cruciate ligament (ACL) reconstruction has been documented to have inferior outcomes compared with primary ACL reconstruction. The reasons why remain unknown.

Purpose: To determine whether surgical factors performed at the time of revision ACL reconstruction can influence a patient's outcome at 6-year follow-up.

Study design: Cohort study; Level of evidence, 2.

Methods: Patients who underwent revision ACL reconstruction were identified and prospectively enrolled between 2006 and 2011. Data collected included baseline patient characteristics, surgical technique and pathology, and a series of validated patient-reported outcome instruments: Knee injury and Osteoarthritis Outcome Score (KOOS), International Knee Documentation Committee (IKDC) subjective form, Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and Marx activity rating score. Patients were followed up for 6 years and asked to complete the identical set of outcome instruments. Regression analysis was used to control for baseline patient characteristics and surgical variables to assess the surgical risk factors for clinical outcomes 6 years after surgery.

Results: A total of 1234 patients were enrolled (716 men, 58%; median age, 26 years), and 6-year follow-up was obtained on 79% of patients (980/1234). Using an interference screw for femoral fixation compared with a cross-pin resulted in significantly better outcomes in 6-year IKDC scores (odds ratio [OR], 2.2; 95% CI, 1.2-3.9; P = .008) and KOOS sports/recreation and quality of life subscale scores (OR range, 2.2-2.7; 95% CI, 1.2-4.8; P < .01). Use of an interference screw compared with a cross-pin resulted in a 2.6 times less likely chance of having a subsequent surgery within 6 years. Use of an interference screw for tibial fixation compared with any combination of tibial fixation techniques resulted in significantly improved scores for IKDC (OR, 1.96; 95% CI, 1.3-2.9; P = .001); KOOS pain, activities of daily living, and sports/recreation subscales (OR range, 1.5-1.6; 95% CI, 1.0-2.4; P < .05); and WOMAC pain and activities of daily living subscales (OR range, 1.5-1.8; 95% CI, 1.0-2.7; P < .05). Use of a transtibial surgical approach compared with an anteromedial portal approach resulted in significantly improved KOOS pain and quality of life subscale scores at 6 years (OR, 1.5; 95% CI, 1.02-2.2; P≤ .04).

Conclusion: There are surgical variables at the time of ACL revision that can modify clinical outcomes at 6 years. Opting for a transtibial surgical approach and choosing an interference screw for femoral and tibial fixation improved patients' odds of having a significantly better 6-year clinical outcome in this cohort.

Economic and Performance Analysis of Achilles Tendon Rupture in the National Basketball Association

Meadows, K., Ye, F., Qiu, A., Iyawe, O., & **Kenneth-Nwosa, K.**

Background: Achilles tendon ruptures are common and potentially career-ending injuries for National Basketball Association (NBA) players. Many studies have reviewed the impact of Achilles tendon ruptures on return to play (RTP) and performance, but there are no studies on their economic significance.

Purpose/hypothesis: This study aimed to analyze the economic and performance consequences of Achilles tendon ruptures usingthe cost of recovery (COR) for NBA franchises as well as preinjury salary/career success. It was hypothesized that players with higher preinjury salaries or performance would have an increased COR, higher rates of RTP, and more career success after their injury.

Study design: Descriptive epidemiology study.

Methods: Publicly available data of NBA players who sustained an Achilles tendon rupture between 1990 and 2023 were analyzed. Data were retrospectively gathered by R software code to include players' ages, positions, salaries, pre- and postinjury player efficiency rating, time missed after injury, and RTP. Performance impact was measured by advanced statistics: player efficiency rating, Win Shares per 48 Minutes, and Value Over Replacement Player. Two groups of 3 cohorts were created: All-Star, Starter, and Reserve versus group A (<$3,999,999), group B (≥$3,999,999 to ≤$8,999,999), and group C (>$8,999,999). Analysis of variance with post hoc Tukey tests for continuous data and Fisher exact tests for categorical data was used. Significance levels were set at $P < .05$.

Results: A total of 37 players met the inclusion criteria and played between the years of 1992 through 2019. The mean COR that NBA teams faced was $4 million per player. The cumulative economic loss from Achilles tendon ruptures in the NBA between 1992 and 2019 was $117,578,851. Overall RTP was 78.38%, and 31.03% of players who returned to play were out of the NBA within 3 years. RTP to the highest playing level was highest in group B (45.5%), followed by group A (40%) then group C (12.5%). The COR of All-Star players, Starter players, and Reserve players averaged $5.7 million, $3.4 million, and $3 million, respectively.

Conclusion: This study investigated the financial and performance implications of Achilles tendon ruptures among NBA athletes. Most players struggled to restore their preinjury performance, except for Reserve players. The findings provide valuable insights into the complexities of COR and postinjury performance.

A Pathophysiological Approach for Selecting Medications to Treat Nociceptive and Neuropathic Pain in Servicemembers

Nguyen, K., Beauchamp, D., & **O'Hara, R.**

Introduction: The prevalence of chronic pain of service members (SMs) in the U.S. is estimated to be higher (roughly 31-44%) compared to that of civilian population (26%). This higher prevalence is likely due to the high physical demands related combat and training injuries that are not immediately resolved and worsen over time. Mental Health America reports that chronic pain can lead to other mental health conditions such as severe anxiety, depression, bipolar disorder, and post-traumatic stress disorder. Such mental health conditions can negatively affect job performance, reduce readiness for military duties, and often lead to patterns of misuse of opioid after SMs entering civilian life. The primary objective of this

narrative review is to present a summarized guideline for the treatment of two types of pain that likely affect SMs, namely nociceptive somatic pain and neuropathic pain. This review focused on a stepwise approach starting with nonopioid interventions prior to opioid therapy. The secondary objective of this review is to elucidate the primary mechanisms of action and pathways associated with these two types of pain.

Methods: We followed the Scale for Assessment of Narrative Review Articles when transcribing this narrative review article to enhance the quality and brevity of this review. This Scale has 0.77% an intra-class coefficient of correlation, 95% confidence interval and 0.88 inter-rater reliability. We searched PubMed, Google Scholar, WorldCAT, and the Cochrane Library for the primary and secondary articles that targeted mechanisms of action, pathways, and pharmacological modalities for nociceptive somatic and neuropathic pain that were published from 2011 to 2022. We excluded articles related to pediatric, some specific pain conditions such as cancer-related pain, palliative care, end-of-life care, and articles that were not written in English language. For pharmacologic selection, we adopted the guidelines from the Policy for Implementation of a Comprehensive Policy on Pain Management by the Military Health Care system for the Fiscal Year 2021; the Clinical Practice Guidance for Opioid Therapy for Chronic Pain by the Department of Defense/Veterans Health Administration (2022); the (2021) Implementation of a Comprehensive Policy on Pain Management by the Military Health Care System; and the (2022) Guideline for Prescribing Opioids for Chronic Painby the Centers for Disease Control.

Discussion: From the knowledge of the mechanisms of action and pathways, we can be more likely to identify the causative origins of pain. As a result, we can correctly diagnose the type of pain, properly develop an efficient and personalized treatment plan, minimize adverse effects, and optimize clinical outcomes. The guideline, however, does not serve as a substitute for clinical judgment in patient-centered decision-making. Medication choices should be individualized judiciously based on the patient's comorbid conditions, available social and economic resources, and the patient's preferences to balance the benefits and risks associated with various pain medications and to achieve optimal pain relief and improve the patient's quality of life.

Resident Perceptions of Virtual Reality Versus Dry Lab Simulation for Advanced Shoulder Arthroscopy Resident Training

Rivera, J., **Johnson, A.,** Burns, T., & Roach, C.

Introduction: Surgical training using simulation can fill gaps in traditional surgical residency learning. We hypothesize that arthroscopy training conducted on a virtual reality simulator will be preferred by orthopaedic surgery residents over a traditional dry lab simulation model.

Methods: 38 orthopaedic surgery residents at a single U.S. residency program were randomized to train for a shoulder arthroscopy procedure using either a virtual reality simulator or a table-top dry lab simulator. Training and learning preferences were then asked of the resident participants.

Results: Junior residents were likely to report training preference for the virtual reality simulator compared to senior residents [15/24 (62.5%) v. 8/14 (57.1%); P = .043]. Simulator preference was not influenced by subspecialty interest, prior arthroscopy experience, or simulator experience. Virtual reality simulation was associated with positive attitude towards arthroscopy and high chance of reporting learning gains on general arthroscopic understanding. Senior residents were 4.7 times more likely than juniors to report learning gains via staff discussion pre- and post-operatively. A majority of residents [34/38 (89.5%)] reported, however, wanting more simulation for training surgical skills.

Conclusion: Simulation is a desired and potentially valuable adjunct to training orthopaedic residents in arthroscopy. Training needs do evolve; and junior arthroscopists may benefit more from virtual reality platforms for general skills. Senior residents preferred dry lab simulation, possibly because it allowed for handling of actual instruments and implants.

Open Capsular Repair with Dermal allograft and tarsal tunnel release in the treatment of Tarsal Tunnel Syndrome in a Young Collegiate Athlete: A Case Report

Ubanwa, B., Emukah, C., **Heath, D.**, Chapentier, M., Cone, R., **Kenneth-Nwosa, K.,** & Bartush, K.

Tarsal tunnel syndrome is an entrapment neuropathy of the posterior tibial nerve beneath the flexor retinaculum that can be precipitated by either intrinsic or extrinsic factors. We report a unique case of a posterior medial ankle joint capsular defect with localized fluid extravasation between the flexor digitorum longus and flexor hallucis longus leading to symptoms consistent with tarsal tunnel syndrome in a collegiate tennis player. This patient is a 19-year-old female with no past medical history who presented with symptoms consistent with tarsal tunnel syndrome. After confirmation with magnetic resonance imaging, the patient underwent capsular reconstruction with dermal allograft in combination with a tarsal tunnel release. The patient had improvement in pain and recovery of paresthesia 3 months postoperatively. At the latest follow-up of 1 year postoperatively, the patient has not had a recurrence of symptoms and has returned to the same level of competitive play. Many different causes of tarsal tunnel syndrome are described in the literature, but to our knowledge, there is no current literature that describes a defect in the tibiotalar joint capsule as a cause of tarsal tunnel syndrome.

05

Alumni

Alamo Orthopaedic Society

Animesh Agarwal, MD, President/Treasurer

The Alamo Orthopaedic Society was established in 1972 by Dr. Charles Rockwood, Jr. as the official alumni association for the Department of Orthopaedics at UT Health San Antonio. The establishment of Orthopaedics at UT Health San Antonio pre-dated the actual opening of the school by two years when Dr. Rockwood was recruited to establish an orthopaedic program in 1966.

Our 2024 Alamo Orthopaedic Society Biennial Meeting held on April 19-21, 2024 at the incredible JW Marriott Resort was a success. Although we had a small contingency of alumni attend, it was great to see old friends. Planning is already underway for our next meeting in 2026. It will be held once again at the JW Marriott Resort in San Antonio on the weekend of April 24-26th, 2026. Please make an effort to attend and get your fellow classmates to join you.

Unfortunately, these past several years, it seems that I have had sad news to include in the Alamo Orthopaedic Society update. It is with great sadness that we have lost another member of the Alamo Orthopaedic Society, Dr. Larry Trick passed away on March 15, 2025. Larry was one of the first military residents to come through the program and over the years became a resident favorite while working with him down at Methodist Metropolitan Hospital. He was an exceptional joint surgeon, and those of us that had the opportunity work with him, learned a lot. Larry was always active in and supportive of the Alamo Orthopaedic Society. He tried to attend every biennial meeting as well as our annual AAOS Alamo reception. RIP Larry!

We just held our AAOS annual reception in San Diego at the Nolen Rooftop Bar and Larry was truly missed. Our turnout was not great once again as many members did not make the trip to the West Coast for this year's academy meeting. Although we had a small gathering, the event was enjoyed by all that came. We will be planning our next reception for New Orleans for the 2026 AAOS. Date and venue TBD.

The society continues to have approximately 100 active members, which continues to decline, and is still only a fraction of the over 300 that have graduated from this program. We have had 7 AAOS Presidents that have been affiliated with our program, which is an amazing achievement [Hinchey (1971), Rockwood (1984), Morrey (1994), Heckman (1998), Teuscher (2015), Williams (2016), Guy (2021)]. I urge many of you that may have let your membership expire to renew and re-engage with the society and the department. Although you will always be an alumnus of the program, dues help to cover expenses for the AAOS reception as well as the biennial meeting. Anna Conti continues to serve as the administrator for the society. Please contact me agarwal@uthscsa.edu or Anna Conti@uthscsa.edu for more information.

1. 2024 Alamo Orthopaedic Society Biennial Meeting (AOSM) group photo.

2. 2025 AAOS Alamo Reception Current PGY-5 Class: (left to right) Sam Ornell, Annat Houston, Stephanie Jones, Ezekiel Koslosky, Loc-Uyen Vo, and Kyle Paul (PGY-4).

3. 2025 AAOS Alamo Reception: (left to right) Doug Cromack, Ian Weber '05, Mark Foreman '98, Animesh Agarwal '97, Anil Dutta.

4. 2024 AOSM Larry and Judy Trick. RIP Larry.

5. 2024 AOSM Current Faculty: (left to right) Phil Jacobs '97, Boris Zelle, Animesh Agarwal '97, Thomas Hand '19, Anil Dutta, Ravi Karia '09.

6. 2024 AOSM: Residents at the meeting – (left to right) Connor Armstrong '24, Clint Ulmer '24, Jordan Carter (PGY-4), Megan Womack '24.

7. 2024 AOSM: (left to right) David Clare '99, Stephen McCollam '87, Animesh Agarwal '97, Ravi Karia '09, Joshua Woody '10, Ryan Thomas '10.

UT Health San Antonio Orthopaedic Surgery Alumni by Class

Class of 1971
Robert D. Bilderback
Michael V. Galo
Thomas R. Reid
Robert G. Stone
Hilario Trevino

Class of 1972
Juan J. Capello
Gary N. Pamplin
Vernon L. Ryan
James M. Steel
Joe W. Tippett
Richard P. Wilson

Class of 1973
Edward D. Campbell, Jr.
Ralph D. Cash
Warren W. Kendall
John T. Phillips
Rafael V. Urrutia, Jr.
Charles M. Younger

Class of 1974
John R. Anderson
George N. Armstrong, Jr.
John E. Blattman
William A. Graham
William H. Matthews
Richard W. Williamson, Jr.

Class of 1975
James W. Adams
Jesse C. DeLee
John A. Genung
Glenn C. Terry

Class of 1976
Billy E. Allison
Robert K. Blair
Jack W. Crosland, III
Ray M. Fitzgerald
John A. Richards

Class of 1977
C. Robert Boone
Phillip R. Craven
Donald R. Davis
Jerold N. Friesen
Raymond S. Gruby
James E. Keever

Class of 1978
William M. Allen, Jr.
Kenneth P. Butters
Fred G. Corley, Jr.
Donald C. Jones
Randy J. Pollet
Archie K. Whittemore

Class of 1979
Ray A. Fambrough
Howard G. Miller
C. Bart Norton
William E. Sanders
Wilburn A. Smith, Jr.
R. Fred Torstrick

Class of 1980
Michael B. Clendenin
Charles E. Lewis
Peter L. J. McGanity
Wayne L. McLemore
James B. Stiehl
John (Jack) M. Thomas, Jr.

Class of 1981
Thomas O. Clanton
Gary H. Jackson
Allen S. Kent
Robert B. Kimmel
Michael R. McLean
Loddie F. Roeder

Class of 1982
Jonathan P. Bacon
Steven C. Dickhaut
Donald W. Floyd
James L. Griffin
Walter M. Knight
Joe B. Wilkinson

Class of 1983
George S. Edwards, Jr.
James B. Giles
Alan G. Lewis
Edward C. Liu
Mark B. Riley
Elizabeth A. Szalay

Class of 1984
Stephen E. Earle
Gary P. Goodfried
Theodore T. Peters
G. Steven White

Class of 1985
Carey C. Alkire
Hal S. Crane
Ralph J. Curtis, Jr.
Michael L. McCarty
Robert E. Mitchell
David R. Schmidt

Class of 1986
Eric C. Carlson
Jeffrey T. DeHaan
Phillip M. Graehl
Michael J. Hanley
Scott H. Kitchel
Matthew C. Reckmeyer

Class of 1987
Jon T. Abbott
Daniel K. Guy
Stephen M. McCollam
Daniel G. Nelson
Jacob F. Patterson
Rex E. Wilcox

Class of 1988
Ples L. Kujawa
James M. Odor
John C. Pearce
Pat A. Peters
Ronald E. Talbert
Donald R. Watson

Class of 1989
Donna M. Boehme
Jimmy H. Conway
Daniel E. Cooper
Stewart M. Dean
Gerald R. Williams

Class of 1990
Jerry A. Benham
Gary T. Brock
Daniel F. Craviotto, Jr.
Kerry M. Donegan
Kurt J. Kitziger
Michael A. Wirth

Class of 1991
Joseph W. Clark
Frank J. Garcia
Carolyn M. Hyde
David E. Nonweiler
James O. Sanders
John C. Sparks, Jr.
Daniel C. Valdez

Class of 1992
Robert L. Burke
N. Thomas Carstens
Mark S. Failinger
Manuel E. Molina
Keith J. Odegard
Barry L. Veazey

Class of 1993
Jerry L. Followwill
Michael G. McNamara
Praveen K. Reddy
Francisco J. Rodriguez, Jr.
Mark J. Rosen

Class of 1994
Keith D. Bjork
Mario A. Bustamante-Montes, Jr.
Kathryn A. Caulfield
Robert W. Dennis
Eduardo Gomez
Dean N. Walker

Class of 1995
John W. Gardemal
Christopher K. Hersh
John W.P. Horan
Todd C. Johnson
James M. Lovelace
Tommy L. McMillion
Joseph O. Muscat

Class of 1996
Bradley J. Broussard
Robert E. Carlson
Jon M. Goodnight
Randall R. Hardison
Sanjay Misra

Class of 1997
Animesh Agarwal
Theresa L. Colosi
James P. Flanagan

Dale A. Funk
Miguel A. Hernandez, III
Philip M. Jacobs
Ian S. Kovach

Class of 1998
Neil B. Callister
Mark A. Foreman
Melinda D. Garcia
Matthew P. Simonich
Steven J. Wilson
Robert S. Wolf

Class of 1999
Andrea J. Barrett
G. Troy Birk
David J. Clare
Jeffery V. Meincke-Reza
Brian E. Schulze
Thomas C. Young

Class of 2000
Eric A. Eifler
R. Thane Morgan
John Q. Smith
Robert A. Ward
George N. Zoys

Class of 2001
Lance R. Farnworth
John D. Foote
Gary A. Go
Joseph J. Iero
Keith W. Lawson
Charles F. Mess
Jeffrey R. Schlimmer

Class of 2002
David M. Burt
P. Douglas deHoll
Patrick J. Miller
Alexander S. Rowland
Gregory W. Smith

Class of 2003
Jorge E. Casas-Ganem
William H. Hadnott, III
David A. Hester
Keith R. Johnson
R. Bradley Ray
J. David Schillen
Vudhi V. Slabisak

Class of 2004
Armin Afsar-Keshmiri
Gordon R. Bozarth
Mitchell W. Larsen
James M. Mahalek
Jeffrey B. Phelps
Stacé S. Rust

Class of 2005
Brett C. Anderson
Daniel L. Boyd
Ramon A.C. Esteban
Geoffrey M. Millican
Brian T. Rose
Ian C. Weber

Class of 2006
Matthew S. Grunkemeyer
Brandon R. Horne
Hank L. Hutchinson
Russell C. McKissick

Class of 2007
Doug S. Clouse
Gregory D. Gordon, Jr.
Florian G. Huber
William K. Koeck
Edwin C. Newman, III
Erik V. Nott

Class of 2008
Brent M. Adcox
Stephanie H. Alford
Cody N. Anderson
Jerome M. Benavides
Emeka O. Ofobike, Jr.
Anup A. Shah
Eric M. Stehly

Class of 2009
Jamey W. Burrow
John Paul S. Elton
Ravi A. Karia
Abilio A. Reis
Patrick W. Sander
Brandon A. Tinkler

Class of 2010
Matthew C. Murray
Arthur L. Strahan
Ryan B. Thomas
Hussein W. Turki
J. Carr Vineyard
Joshua T. Woody

Class of 2011
Justin R. Brazeal
Michael E. Johnson
Farbod Malek
Guy E. Reyes, Jr.
Brandon M. Seifert
Michael S. Vrana

Class of 2012
Alison L. Cabrera
John W. Hinchey
Jason P. Richards
Jay M. Stanley
Zachary S. Stinson
Darin D. Tessier

Class of 2013
William B. Bell
R. Zachary Garza
Daniel R. Grant
Matthew M. Hussey
Matthew C. Kergosien
James R. Meadows

Class of 2014
Frank A. Buttacavoli
Bradley D. Gilliam
Chad M. Kennedy
Aaron M. O'Brien
David M. Rowley
Ian J. Whitney

Class of 2015
J. Cuyler Dear
Robert G.W. Girling, V
Vishwas B. Patil
Jeremy S. Somerson
Marion M. Swall
Michael A. Weathers

Class of 2016
Davin D. Cordell
Ben S. Francisco
Nicholas E. Gerken
Todd C. Pitts
Gurpreet Singh
Danilo M. Volpini

Class of 2017
Kevin D. Christensen
Richard E. Edeen
Jason R. Gray
Brandon D. Mennear
Evan M. Tavakoli
Zibin Zhao

Class of 2018
Katherine C. Bartush
Christina I. Brady
Gregory V. Gomez
Brett M. Hall
Christopher G. Larkins
Gina R. Lesko

Class of 2019
Thomas L. Hand
Andrew M. Lee
Hanna E. Mendez
Chance C. Moore
Jason Thompson
Antonio J. Webb

Class of 2020
Khang H. Dang
Stephen Ernst
Brock T. Kitchen
Kenneth S. Mensch
Alexander V. Nguyen
Nikhil Shelke

Class of 2021
Braden J. Boyer
Ryan C. Egbert
Andrew J. Haus
Isaac S. Kim
Case W. Martin
James C. Ryan

Class of 2022
Jorge C. De Leon
Joel I. Edionwe
Jordan E. Handcox
Dietrich W. Kayser
Riikka E. Koso
Trevor J. Wait

Class of 2023
Jason Goodrum
David Heath
Galen Mills
Liliana Ogden
Gus Jamie Strauss
Adam Ward

Class of 2024
Connor Armstrong
Jacob Brennan
Adam McNulty
Gautham Prabhakar
Clinton Ulmer
Meagan Womack

Class of 2025
Annat Houston
Stephanie Jones
Ezekial Koslosky
Kathleen Lundquist
Sam Ornell
Loc-Uyen Vo

06

Ortho Illustrated

1-2. The Pediatrics team loves delivering some Christmas cheer to the new Women and Children's Tower at University Hospital.

3. Interns enjoying some free time outside of the hospital.

4. Class of 2024 at graduation with Dr. Buttacavoli, outstanding faculty mentor.

5. Dr. Buttacavoli at the new Multispecialty and Research Hospital.

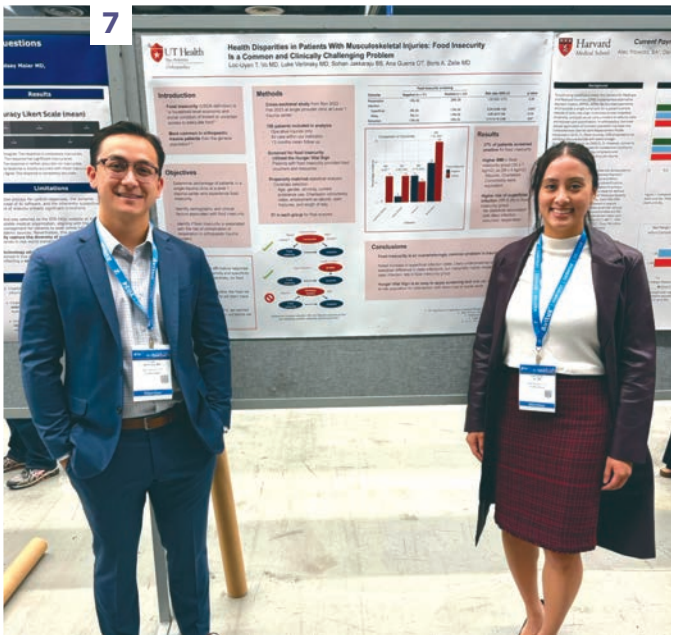
1

2

1-2. A little friendly competition at the annual Thanksgiving Day flag football game.

3. Women in Ortho at the Class of 2024 residency graduation.

3



4. Residents, alumni, and faculty at the annual AAHKS meeting in Dallas.

5. Residents enjoy some downtime in Las Vegaswhile attending a DA Hip Course.

6. Taking in the Redwoods at the Annual AAOS meeting 2024.

7. Residents Loc-Uyen Vo and Luke Verlinsky present their research at the annual OTA meeting.

1. Residents, alumni, and staff at the annual OTA meeting.
2. Faculty and residents at a UTSA football game.
3. Welcome to the new intern class!
4. The PGY-5 class enjoys some fun in the sun at a pool party with faculty.

5. UT Health SA Medical Students at Texas Orthopaedic Association (TOA) meeting 2025.

6. TOA meeting 2025 final competition of the Battle of the Bone Texas Orthopaedic residency skills challenge.

7. Resident skills competition (from left to right) Zachary Jodoin MD (competitor), Brian Sager MD (judge), Casey McDonald MD (competitor), Ezekial Koslosky MD (judge), Luke Verlinsky MD (competitor) and Christina Brady MD (judge)

The Murph Challenge

Murph Challenge 2024 at OnePlus CrossFit, Sponsored by Dr. Boris Zelle

MORE THAN A WORKOUT

- 1-mile run
- 100 pull-ups
- 200 push-ups
- 300 squats
- 1-mile run

Every year on Memorial Day, a group of orthopaedic residents and faculty gathers to honor of our fallen heroes. The event which started as a memorial to LT. Michael P. Murphy Michael has grown into worldwide participation with thousands involved from every part of the globe. The Murph Challenge campaign has raised substantial funds for the LT. Michael P. Murphy Memorial Scholarship Foundation.

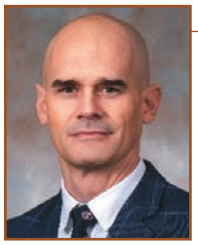
The Story

LT. Michael P. Murphy (SEAL) was the officer-in-charge of a four-man SEAL running an operation near Asadabad, Afghanistan. After inserting into the objective area, the SEALs were spotted by three goat herders who were initially detained and then released. It is believed that the goat herders immediately reported the SEALs' presence to Taliban fighters. A fierce gun battle ensued on the steep face of the mountain between the SEALs and a much larger Taliban enemy force. Lt. Murphy is credited with risking his own life to save the lives of his teammates. Murphy attempted to contact the headquarter for support but realized that this was impossible in the extreme terrain. With complete disregard for his own life, he moved into the open, where he could transmit a call to get help for his men. Moving away from the protective mountain rocks deprived him of cover and exposed him to enemy gunfire. Murphy made contact with the SOF Quick Reaction Force at Bagram Air Base and requested assistance for his team. Severely wounded, LT. Murphy returned to his cover position with his men and continued the battle. LT. Murphy fought on, allowing one member of his team (Marcus Luttrell) to escape. LT. Michael Murphy was posthumously awarded the Congressional Medal of Honor on October 27, 2007. His story is depicted in the movie "Lone Survivor," where he was portrayed by Taylor Kitsch.

The Workout

It is important to remember that the Murph Challenge is more than just a workout. It is a tradition that helps push us, humble us, and allows us the opportunity to dedicate a bit of pain and sweat to honor LT. Michael P. Murphy (SEAL), a man who sacrificed his life for our freedom. The Murph Challenge includes a 1-mile run, followed by 100 pullups, 200 pushups, 300 air squats, and finishing with another 1-mile run.

Visiting Professors



Philip A. Deffer, Sr., MD Endowed Lectureship
April 15, 2024

Benjamin Kyle Potter, MD, Chair of the Department of Orthopaedic Surgery at Penn Medicine, retired as Colonel from the US Army in 2023 after 22 years of active-duty service. Prior to joining Penn Medicine, he served as Norman M. Rich Professor and Chair of The Department of Surgery at The Uniformed Services University of the Health Sciences & Walter Reed National Military Medical Center, Director of the Department of Defense Limb Optimization and Osseointegration Program, and Chief Orthopaedic Surgeon for the Amputee Program. While joining us in San Antonio, he gave a stimulating Grand Rounds presentation on Limb Optimization and Redefining Limb Salvage and Amputation Surgery, which was followed by interactive teaching and case presentations with the residents.

Rockwood Endowed Orthopaedic Lecture Series
June 21, 2024

Steven S. Shin, MD is Executive Vice Chairman and Professor of Orthopaedic Surgery at Cedars-Sinai. He specializes in the treatment of hand and upper extremity injuries in athletes. He received his MD from Brown University, completed his Orthopaedic Surgery residency at NYU-Hospital for Joint Diseases, and completed a Hand Surgery fellowship at Stanford. Today, he serves on the editorial panels for both JBJS and Orthopaedics Today and as Chair of the hand and wrist program committee for the AAOS. While joining us in San Antonio, he gave a compelling talk about Sports Injuries of the Hand and Wrist and joined us for the Graduation Ceremony for the class of 2024.

Laura B. Flawn, MD Endowed Professorship in Diseases of the Spine and Spine Trauma
October 7, 2024

Rex A. W. Marco, MD, is a Professor in the Department of Orthopedic Surgery at McGovern Medical School at UT Health Houston as well as the Program Director for the Orthopaedic Spine Fellowship. He received his Medical Degree from the UCLA School of Medicine and completed his orthopaedic surgery residency training at The University of California – Davis Medical Center. He then completed two fellowships in musculoskeletal oncology at Memorial Sloan Kettering Cancer Center followed by a reconstructive spine surgery fellowship at Rush-Presbyterian-St. Luke's Medical Center in Chicago. While joining us in San Antonio, Dr. Marco gave a moving Grand Rounds presentation entitled "When Life Takes Your Breath Away" detailing his life after a bicycle accident in 2019 that left him paralyzed. "May I be kind and compassionate. Humble and accepting. Honest and accountable. Forgiving and committed," he says. "When I notice myself struggling with negative thoughts, I pause, breathe and relax."

Grand Rounds Visiting Professor
April 29, 2024

Antonia Chen, MD, MBA is Professor and Chair of the Department of Orthopaedic Surgery at UT Southwestern Medical Center. She earned her medical degree at Rutgers' Robert Wood Johnson Medical and her MBA at Rutgers Business School. She then completed her residency in Orthopaedic Surgery at the University of Pittsburgh followed by a fellowship in Adult Reconstruction at the Rothman Institute in Philadelphia. Prior to joining UT Southwestern, Dr. Chen served as an Associate Professor at Harvard Medical School and was Chief of Arthroplasty and Joint Reconstruction at Brigham and Women's Hospital in Boston. Dr. Chen also holds editorial positions with several academic journals and leadership roles in national organizations including the American Association of Hip and Knee Surgeons, where she is currently the second Vice President. While joining us in San Antonio, she gave a thought-provoking Grand Rounds presentation on Preoperative Patient Optimization Prior to Orthopedic Surgery and attended a Journal Club with San Antonio residents and faculty.

Grand Rounds Visiting Professor
June 17, 2024

Rachel Vickery, MHSc is an internationally respected subject matter expert helping people optimize performance in high pressure, high stakes environments. She started her career as an International Gymnast on the New Zealand National Team and competed in the World Championships and Commonwealth Games. She now works with professional athletes and coaches, military teams, executive,

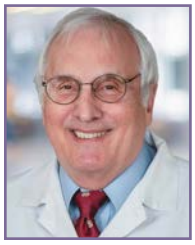
and medical professionals providing tools to help excel in high pressure moments and careers. While joining us in San Antonio, she gave a compelling Grand Rounds presentation on "Transforming the Surgeon Mindset: Protecting the Sharpest Scalpel."

Grand Rounds Visiting Professor September 16, 2024

Dr. Christian Gerber, MD, PhD is a renowned surgeon-scientist and Professor and Chairman Emeritus of the Department of Orthopaedics at the University of Zürich in Switzerland. After completing his medical degree at the University of Berne, he completed his training in Orthopaedic Surgery in Switzerland at several hospitals including Davos Hospital and the University Hospital of Berne. In 1984, he was one of the first shoulder fellows at UT Health San Antonio under Dr. Charles A. Rockwood. Dr. Gerber is known for his extensive work on traumatic and atraumatic pathologies of the shoulder. He has authored over 450 scientific articles and is a four-time winner of the Charles S. Neer Award of the American Shoulder and Elbow Surgeons. While joining us in San Antonio, he gave an insightful Grand Rounds presentation entitled, "What Do I Think is Important for rTSA 40 Years After Fellowship?" followed by a Journal Club with San Antonio residents, fellows, and faculty.

Endowments

Orthopaedics



THE FRED G. CORLEY, MD CHAIR IN ORTHOPAEDICS, #57700223. This endowment was established in July 2004. Ravi Karia, MD was appointed holder of this prestigious endowment on December 1, 2020. This endowment was established to honor Dr. Corley who is one of our most respected long-term faculty. He has special expertise in surgery of the upper extremities, especially in management of trauma of the elbow, wrist, and hand. He serves as a role model for Medical Students and Residents and has been the Chief of the Hand Services at this institution for over two decades. The purpose of this endowment is to support the Distinguished Professorship and establish a permanent education resource for training Residents and Medical Students in surgery of the hand, shoulder and elbow.

JOHN J. HINCHEY, MD AND KATHRYN HINCHEY CHAIR IN ORTHOPAEDICS, #57700024 QUASI, #57700444, are held by Robert H. Quinn, MD These endowments were established in 1992 to honor Dr. Hinchey for his tremendous contributions to Orthopaedics and to the total medical community during his many years of Orthopaedic practice in San Antonio. Dr. Hinchey died on March 3, 2000; Mrs. Kathryn Hinchey died in December 2011. The purpose of the endowment is to establish an endowed position in the Department of Orthopaedics to support clinical and basic research.

CHARLES A. ROCKWOOD, JR., MD, CHAIR IN ORTHOPAEDICS, #57700058 AND CHARLES A. ROCKWOOD, JR., MD CHAIR IN ORTHOPAEDICS QUASI, #57700574. Anil K. Dutta, MD was appointed to this prestigious endowment on December 1, 2020. These endowments were established in 2003 to honor Dr. Rockwood who is recognized internationally for his contributions to Orthopaedic Surgery. Dr. Charles A. Rockwood, Jr., Emeritus, Department of Orthopaedics at UT Health San Antonio died on February 1, 2022; his name, inventions and textbooks will persist for decades to come. The endowments were created to support research and education specializing in shoulder disorders in the Department of Orthopaedics at UT Health San Antonio. These endowments were previously held by Michael A. Wirth, MD who retired on June 30, 2019.

PRESIDENT'S COUNCIL/DIELMANN CHAIR IN PEDIATRIC ORTHOPAEDIC SURGERY, #57700241. Sekinat K. McCormick, MD was appointed holder of this prestigious endowment on October 1, 2021. This endowment was established in 2005 to honor Henry B. and Edna Smith Dielmann. Mrs. Dielmann, a community philanthropist died in 2002 and left a generous portion of her estate to UT Health San Antonio. She was the widow of Henry B. Dielmann, a prominent San Antonio attorney, three-time member of the Texas House of Representatives and former Dean of St. Mary's University Law School in San Antonio. This endowment was created to provide Pediatric Orthopaedic training and programs to Medical Students and Residents at UT Health San Antonio as well as specialty training to countries with limited resources.

ERWIN ORTHOPAEDIC SARCOMA RESEARCH ENDOWMENT IN HONOR OF DR. RAJIV RAJANI, #57700616. This QUASI endowment was received from the Erwin Family Foundation in honor of Dr. Rajiv Rajani. Funds distributed from the endowment will be used to provide support for research, visiting professors, and work dedicated to treatment options for bone and soft tissue sarcomas, under the direction of the Chair of the department in accordance with the Regents' Rules and Regulations.

FRANCES AND BLACKSTONE DILWORTH PROFESSORSHIP IN ORTHOPAEDIC ONCOLOGY, #57700639. Joseph F. Alderete Jr., MD, FAOA was appointed holder to this prestigious endowment on June 1, 2024. Funds distributed from this endowment shall support the Professorship in accordance with the Regents' Rules and Regulations and applicable policies pertaining to endowed academic positions. As additional funds are received, this endowment will be elevated to the highest level of endowment for which it qualifies.

KAYE E. WILKINS, D.V.M., MD ORTHOPAEDIC PROFESSORSHIP, #57700675. Steven D. Gibbons, MD was appointed holder to this prestigious endowment on April 1, 2024. This endowment was created to honor the legacy of Dr. Wilkins by contributing to the musculoskeletal care of children. Funds distributed from the endowment shall be used to support the Professorship in accordance with the Board of Regents' Rules and Regulations and applicable policies pertaining to endowed academic positions. Distributions may also be used to support residents within the school. Endowment is unfilled.

STEVE AND MARY ANNE LYNCH PROFESSORSHIP IN MEDICINE, #57700706. Kenneth-Nwosa, MD was appointed Holder to this prestigious endowment on August 1, 2023 for a five-year term. This endowment was created to benefit a promising "rising star" faculty who is dedicated to excellence in patient care, teaching and mentoring students/ residents with special interest in Orthopaedics and other clinical specialties at UT Health San Antonio. Funds distributed from the endowment will support the Professorship in accordance to the Regents' Rules and Regulations and applicable policies pertaining to endowed academic positions.

DR. ROBERT AND DR. LOUISE HUTCHINSON ENDOWMENT FUND FOR BASIC RESEARCH IN ORTHOPAEDIC SURGERY, #57700729. Vaida Glatt, PhD was appointed holder to this prestigious endowment on September 1, 2024. This is a Miscellaneous Endowment created from their Charitable Trust Fund in September 2022. Funds distributed from the endowment shall be used for basic research in Orthopaedic Surgery.

Orthopaedics Supporting Honorary Lectureships

THE CHARLES A. ROCKWOOD, JR., MD ENDOWED LECTURE SERIES, #57700233 was established in November 2004. We appreciate Dr. Rockwood's recognition of the Orthopaedic Residents as they graduate from our Residency Program. Dr. Charles A. Rockwood, Jr., Emeritus, Department of Orthopaedics at UT Health San Antonio died on February 1, 2022; his name, inventions and textbooks will persist for decades to come. This endowment was created to defray all or part of the expenses associated with the annual Orthopaedic Resident Graduation. This includes expenses to invite a distinguished guest lecturer and expenses associated with the Grand Rounds lecture, evening lecture and Graduation. Holder is not required.

THE PHILIP A. DEFFER, SR., MD LECTURE SERIES, #57700070 was established in 1994. Dr. Deffer was a Retired Brigadier General, Associate Professor in the Department of Orthopaedics and Rehabilitation at the Health Science Center and Director of the Orthopaedic Clinics at the University Health Center-Downtown from 1982-2003. Dr. Deffer died on October 26, 2006. The sole purpose for this endowment is to defray or offset expenses associated with inviting a distinguished guest speaker to the annual educational lecture to interact, share experiences and offer insights with our Residents and Medical Students. Holder is not required.

THE LAURA B. FLAWN, MD ENDOWED DISTINGUISHED PROFESSORSHIP IN DISEASES OF THE SPINE AND SPINE TRAUMA, #57700189 was established in 2002. Christopher Chaput, MD was appointed to this prestigious endowment effective January 1, 2019. Dr. Flawn received high praise for her surgical skill and her contributions to the advancement of surgery of the spine before and after her death on October 20, 2001. She was active in the Scoliosis Research Society and pioneered the development of practices and procedures to improve the treatment of scoliosis. The purpose of this endowment is to support the Distinguished Professorship and hold the annual Laura B. Flawn, MD Lecture. The annual lecture benefits Medical Students, Residents and Faculty at UT Health San Antonio. It is funded by Dr. and Mrs. Peter Flawn, Dr. John P. Howe, III and Ms. Tyrrell Flawn.

Podiatry

LOUIS T. BOGY, D.P.M. PROFESSORSHIP IN PODIATRIC MEDICINE AND SURGERY, #57700098. Lee C. Rogers, DPM, FFPM, RCPS was appointed to this prestigious endowment on August 1, 2022. This Professorship was established in 1998 to honor Louis T. Bogy, Chairman Emeritus of the Podiatry residency training program at UT Health San Antonio. Dr. Bogy was instrumental in establishing the residency training program, which began in 1972 with one Resident. More than 100 Residents have graduated since 1972. Dr. Bogy died on February 9, 2004. The first supported faculty member to be supported by this Professorship was Lawrence Harkless, D.P.M. from 1999 to 2007. This endowment was created to support the Professorship, research and resident education in the area of diabetic foot care.

LEE J. SANDERS, MD PROFESSORSHIP IN LOWER EXTREMITY AMPUTATION PREVENTION, #57700196. Collin E. Pehde, DPM was appointed Holder of this prestigious endowment on August 1, 2023 for a five-year term. The Professorship was established in 2003 to honor Lee J. Sanders, D.P.M, Chief of Podiatry Service, Acute Care, and Specialty Services at the Veterans Administration Medical Center in Lebanon, PA. Dr. Sanders is one of the foremost leaders in prevention of lower-extremity amputation in diabetics. The purpose of the Professorship would be to support a faculty member in the Podiatry Division of the Orthopaedic Department and to support podiatric research and education in amputation prevention and other podiatric needs deemed appropriate by the Chair of Orthopaedics.

THE LAWRENCE B. HARKLESS D.P.M. ENDOWED PROGRAM FUND IN PODIATRY, #57700476. Endowment was created March 26, 2014 with a $10,000 gift from G. Javier Cavazos, Jr., D.P.M. received in November 2007 to support an endowment for the Orthopaedics Department, Podiatry Division in the School of Medicine. Future plans will be to use this endowment for Podiatry Faculty research, travel and miscellaneous expenses to support the academic mission of the Program Fund in Podiatry.

ENDOWMENTS ARE SUPPORTED THROUGH THE OFFICE OF DEVELOPMENT:

Interested in Giving? To make a gift to any of our prestigious endowments, please contact Collette Wixom, Executive Director of Development, Long School of Medicine, UT Health San Antonio, Office of Institutional Advancement, 7703 Floyd Curl Drive, MC 7835, San Antonio, TX 78229-3900, wixomcall@uthscsa.edu, 210-567-2575 -or-Shelby Briscoe, Department of Orthopaedics, UT Health San Antonio, 7703 Floyd Curl Drive, MC 7774, San Antonio, TX 78229-3900, briscoes@uthscsa.edu, 210-567-4789. Thank you!

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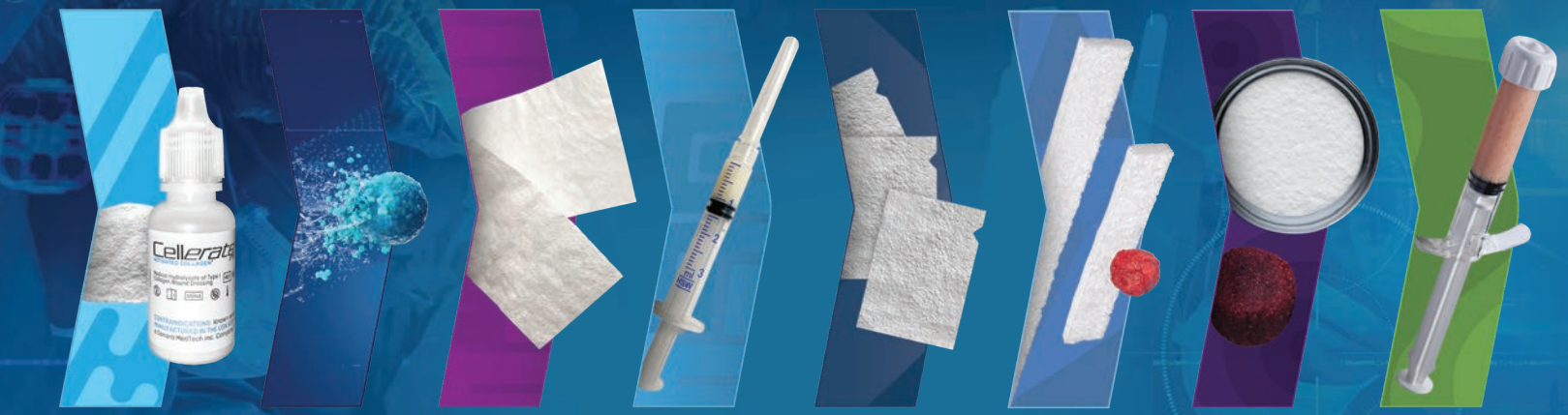

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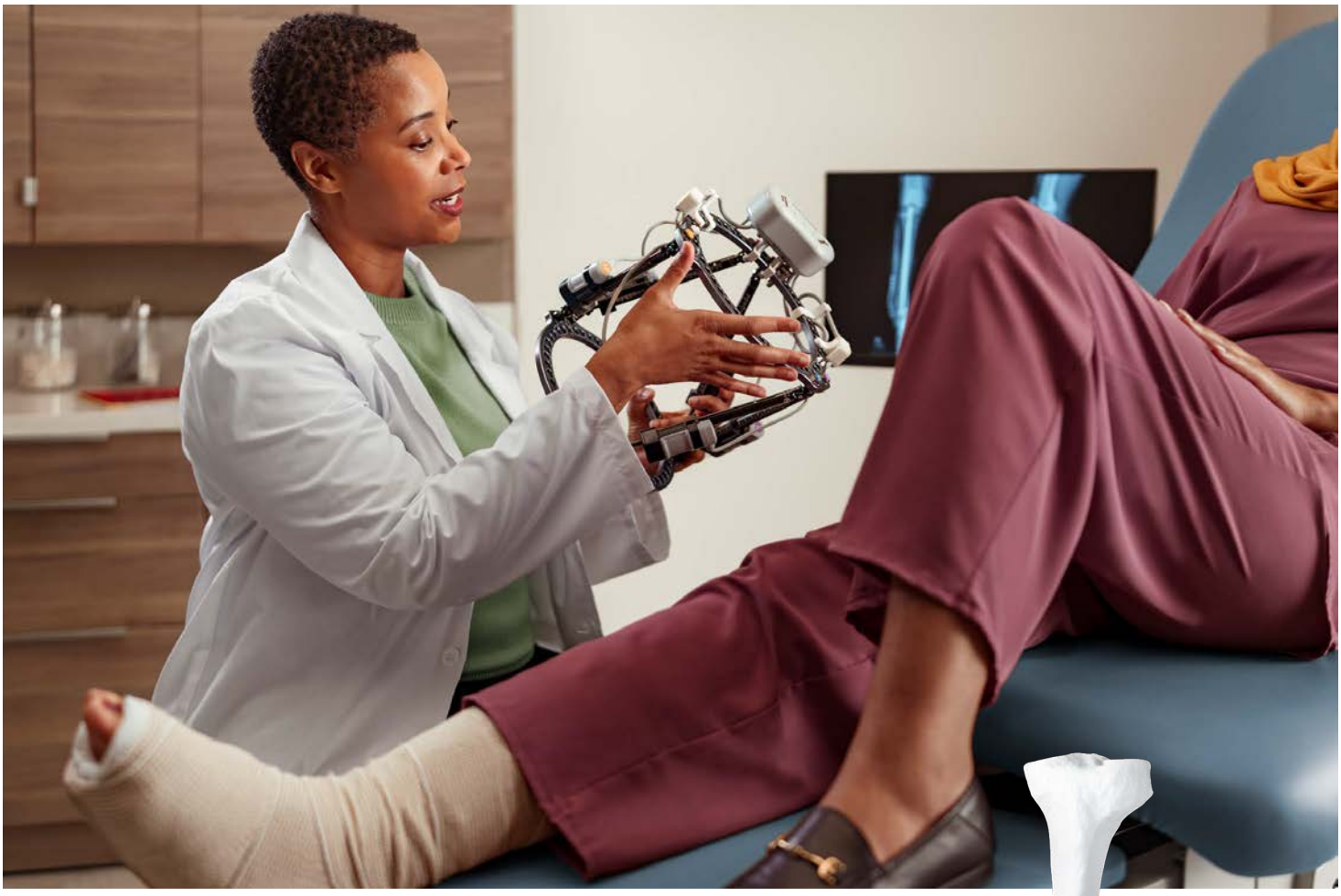

The first-of-its-kind hexapod ring fixation system offering fully automated strut adjustments up to 20 times per day.[2,3,*,†]

Important Information: Prior to use, refer to the instructions for use supplied with the device(s) for indications, contraindications, side effects, warnings and precautions.

CAUTION: Federal Law restricts these devices to sale by or on the order of a physician.

*Geffner et al, 2021 is an n=1 pediatric case study. Clinical outcomes in these cases may not be representative of outcomes in other patients. †Preclinical studies may not be indicative of clinical performance.

1. OrthoSpin. MAXFRAME AUTOSTRUT Surgeon User Manual. 03/2022. OrthoSpin Document #IFU-0140 Rev. B.
2. Geffner AD, Reif TJ, Fragomen AT, Rozbruch SR. Use of OrthoSpin technology in the correction of complex limb deformities. J Ann Robot Automation. 2021;5(1):037-041.*
3. DePuy Synthes. MAXFRAME AUTOSTRUT and Distraction Considerations for Patient Treatment: Pre-Clinical, ClinicalMedical Affairs (PCM) Memo. 02/2022. Windchill #0000315770. †

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Photo by Boris A. Zelle, MD, MBA