Welcome to the 71st Annual Western Neurosurgical Society Meeting.

"The Changing Landscape of Neurosurgery: Honoring Firsts, Shaping Futures"

Our Annual meeting is a reflection of the strength, commitment and dedication of an extraordinary community. The meeting is dedicated to honoring our incredible history while appreciating the changing landscape of neurosurgery. The meeting builds on our exceptional past, a foundation established by our 68 past presidents (*some of whom have served twice*). We hope this meeting honors their contributions and the path forward they boldly created.

Our Scientific Chair, Dr Ben-Haim, and the Program Committee have engaged an exceptional roster of Speakers. The scientific program promises to highlight the best and most innovative science in the field.

All our **eponymous lectures and awards** reflect the privilege of our society in attracting and honoring the best in the field including Dr Steven Giannotta (Cloward Lecture), Dr Karin Muraszko (Randy Smith Lecture) and Dr Jonathan Chen (Prolo Lecture).

Additionally, we are proud to pay homage to our future, as we honor our **residents** both those attending and those being recognized for their outstanding work. Congratulations to Dr Shivani Baisiwala (Clinical Science Award) and Dr Anthony Lee (Basic Science Award).

We also welcome our **new members**, who bring unprecedented talents and vigor to our society.

This is an exciting time to be a neurosurgeon and this meeting captures and reflects all that is to be lauded.

Please allow me to thank our many chairs and committee members and volunteers who do the hard work of the Society.

Thanks to our Sponsors whose generous support allows us to charge forward and innovate. Their partnership is invaluable.

Thanks to Dr Justin Dye and Ms Darla Colohan – this and most meetings could not be possible without them.

Thanks also to YOU, our members, for joining us and for supporting the Western.

As we celebrate our 71st annual gathering, let us be reminded of the charge of our immediate Past President, Dr Marco Lee, "…honor the past, embrace the present and look ahead to the future with promise and discovery…"

Welcome everyone.
Celebrate and Enjoy the Meeting!!!!

Odette Harris, MD, MPH

Western Neurosurgical Society
71st Annual Meeting

2025 Educational Objectives

After completing this activity, participants should be better able to:

- Increase their confidence in the neurosurgical care of pediatric intracranial pathology
- Increase their confidence in the neurosurgical care of cerebrovascular surgery
- Understand the impact of female leadership in neurosurgery
- Increase their confidence in the execution of spinal surgery best practices
- Improve their understanding of functional neurosurgery and traumatic brain injury

2025 Officers & Committees

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Ray Chu, Chair

2025 WNS Annual Meeting Guests

Steven Giannotta	Cloward Medalist	
Jonathan H. Chen	Prolo Lecturer	
Jim States	Local Interest Lecturer	
Karin Muraszko	Randy Smith Lecturer	
Anthony Lee	Basic Science Resident Award	
Shivani Baisiwala	Clinical Science Resident Award	
Jared D. Ament	Member Nominee	Adair Prall
Karol Budohoski	Member Nominee	Phil Taussky
Abhineet Chowdhary	Member Nominee	Adair Prall
Victor Lo	Member Nominee	Gregory Gerras
Michelle Paff	Member Nominee	Mark Linskey
Martin Pham	Member Nominee	Alex Khalessi
Shervin Rahimpour	Member Nominee	Sharona Ben-Haim
Vijay Ravindra	Member Nominee	Phil Taussky
Julie Pilitsis	Member Candidate	Sharona Ben-Haim
Ali Ravanpay	Member Candidate	Sharona Ben-Haim
Andrew Yang	Member Candidate	Andrew Little
Nathan Han	Member Candidate	Praveen Mummaneni
Craig Kilburg	Member Candidate	Adair Prall
Kenneth De Los Reyes	Professional Guest	Justin Dye
Robert L. Dodd	Professional Guest	Odette Harris
Ioannis Fouyas	Professional Guest	Marco Lee
Theodore Hole	Professional Guest	Moustapha AbouSamra
Jeffrey Larson	Professional Guest	Adair Prall
Andrew Metzger	Professional Guest	Andrew Little
Marc Schwartz	Professional Guest	Sharona Ben-Haim
David Caldwell	Resident Speaker	Sharona Ben-Haim
Steve Cho	Resident Speaker	Sharona Ben-Haim
Khadija Soufi	Resident Speaker	Sharona Ben-Haim
Lily Kim	Resident Speaker	Sharon Ben-Haim

Idaho is nicknamed the “Gem State” because of its abundance of precious and semi-precious stones

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Gary Steinberg	Consultant - SanBio Consultant - Surgical Theater Consultant - Zeiss Royalties - Peter Lazic, US Consultant - Recursion
Karol Budohoski	Consultant - Johnson & Johnson Neurovascular
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Shervin Rahimpour	Speaker - Abbott Laboratories Speaker / Consultant - Boston Scientific Speaker - Neuropace
Craig Kilburg	Consultant - Medtronic Neurovascular Consultant - Stryker Neurovascular Consultant - Phenox

Faculty / Content Developers

Sharona Ben-Haim, MD	UC San Diego Health
Brian Lee, MD, PhD	Keck School of Medicine of USC
Anthony DiGiorgio, DO	UCSF Health
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- Now you are on the "My Continuing Education" page. Click on "Enter Code" button. Enter the code: 20972025
- Confirm the number of credit hours participated in the activity, check the "I Do" box and click "Submit".
- Complete and submit the activity evaluation form (if applicable).
- On the far right, the "Action" box you can print or email your certificate.

Method 2: Using QR code

- Scan the code using your mobile device.

- Enter your name, email, and Authorization code: 20972025
- Select the number of credits claimed.
- Check the "I Confirm my participation" check box and click "Submit".
- You must login to www.yourcesource.org (https://www.yourcesource.org) to print your certificate.

Donald J. Prolo, MD

Donald Prolo has been a member of the WNS since 1974 and an almost constant attendee at our annual meeting.

To anyone who has known Don Prolo over the past few decades, his love of classical thinking and values stands out as a real weathervane for who he is and what he stands for.

Don has been a champion of physician control of patient care as compared to what has become control by government and insurance companies. He gallantly tried, where no others ever went, to get a California based Sherman antitrust exemption so docs could gather together and bargain with the government and the insurance companies for their services. He has continued to work on maintaining physician independence and loudly laments the erosion of private practice with now half of physicians employed by commercial interests.

As he said in his WNS Presidential address in 2002, it is *". . . a citizen's natural right to rebel against unjust positive laws and determinations not made with respect to antecedent principles of natural justice. Coercive threats of fines, sanctions, incarcerations are forces against American medicine without moral authority."* He went on to say, *"In the first two books of the Republic, Plato raised the question why should one be just in his actions toward others or in relation to the community in which he or she lives? The answer lies in the fact that the moral virtues of prudence, temperance, courage and justice underlie happiness, the primary good we desire for ourselves and others."*

In the pursuit of the above values, Don and his wife Joanne have endowed an annual lecture, the Prolo Lecture, to be delivered by diverse speakers addressing professionalism and ethics in medicine.

Prior Prolo Lecturers

2021 Robert Phillips, Jr., MD, MSPH
Executive Director, Center for Professionalism & Value in Health Care of the American Board of Family Medicine
"Professional Autoimmune Disorder and the State of the Social Contract"

2022 Nigel Nicholson, PhD
Walter Mintz Professor of Greek, Latin and Mediterranean Studies at Reed College, Portland, OR.
"Thinking of Yourself as a Doctor"

2023 Kelley Skeff, MD, PhD
George DeForest Barnett Professor, Department of Internal Medicine, Stanford University

2024 Gerald Grant, MD
Chairman Department of Neurosurgery, Duke University
"Intersection of NOTECHS and Neurosurgery"

Prolo Lecturer - 2025

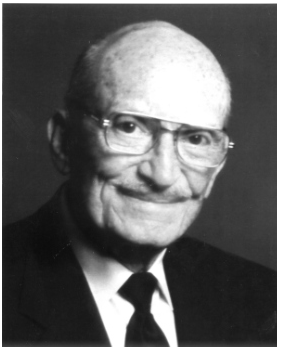
Jonathan H. Chen, MD, PhD

Assistant Professor
Medical Center Line
Center for Biomedical Informatics Research
Division of Hospital Medicine, Stanford Department of Medicine

Jonathan H. Chen MD, PhD leads a research group to empower individuals with the collective experience of the many, combining human and artificial intelligence approaches to deliver better care than either alone. Dr. Chen continues to practice medicine for the concrete rewards of caring for real people and to inspire this research focused on discovering and distributing the latent knowledge embedded in clinical data.

Before his medical training, Chen co-founded a company to translate his Computer Science graduate work into an expert system for organic chemistry, with applications from drug discovery to an education tool for students around the world. His expertise is regularly featured in popular press outlets with over 100 publications in leading clinical and informatics venues and awards from the NIH, National Library of Medicine, American Medical Informatics Association, International Brotherhood of Magicians and more.

In the face of ever escalating complexity in medicine, informatics solutions are the only credible approach to systematically address challenges in healthcare. Tapping into real-world clinical data like electronic medical records with machine learning and data analytics will reveal the community's latent knowledge in a reproducible form. By delivering this back to clinicians, patients, and healthcare systems as clinical decision support, he aims to uniquely close the loop on a continuously learning health system.



Dr. Ralph B. Cloward 1908-2000

In 2002, the Western Neurosurgical Society established a Medal and Lecture to honor one of its most innovative and pioneering members, Ralph Bingham Cloward. With the gracious support of the Cloward family, this award honors Ralph and his devoted wife Florence, our former president and first lady, both treasured friends who have enriched the Western.

Ralph Cloward was born in Salt Lake City, Utah in 1908. He completed his undergraduate studies at the Universities of Hawaii and Utah, and his medical education subsequently at the University of Utah and Rush Medical School in Chicago. He interned at St. Luke's Hospital, Chicago, and then trained to become a neurosurgeon under Professor Percival Bailey at the University of Chicago. He began practicing neurology and neurosurgery in the Territory of Hawaii in 1938.

His academic accomplishments include Professor and Chair of Neurosurgery at the University of Chicago, 1954-55, and visiting professorships at the University of Oregon, University of Southern California, and Rush Medical School. He served long-term as Professor of Neurosurgery at the John A. Burns School of Medicine at the University of Hawaii. He authored numerous papers and book chapters.

Dr. Cloward's inspired, pioneering quantum leaps encompassed many areas of neurosurgery, but his enduring interest was the spine, where he devised three major operations. He first performed the posterior lumbar interbody fusion in 1943, reporting the operation at a meeting of the Hawaiian Territorial Medical Association in 1945 and publishing it in the Journal of Neurosurgery in 1953. His unique approach for treating hyperhydrosis was reported in 1957. Independently he conceived an anterior approach to the cervical spine, devised instruments for its implementation, and published his classic paper in the Journal of Neurosurgery on anterior cervical discectomy and fusion in 1958. He designed over 100 surgical instruments, which continue to be used today by practicing neurosurgeons.

Throughout his career he educated the international community of neurosurgeons in the operations he devised. He performed them throughout the United States and in 41 cities within 27 countries of the world and in the process healed patients of their painful conditions. Hundreds of thousands of patients benefited both directly and indirectly from his creativity, technical genius, insight and enthusiasm as a teacher and medical evangelist.

In first recognizing all lesions of the spine to be in the province of neurosurgeons, Dr. Cloward engendered controversy and endured severe criticism from upsetting the environment of establishment neurosurgeons by his pioneering breakthroughs. He demonstrated that even in a complex technological world with large research efforts, budgets, and bureaucracies, the individual is key. Engraved on the Medal are words the Cloward legacy epitomizes, which honors recipients "For Epochal Innovation and Pioneering Application."

2025 Cloward Award Recipient

Steven L. Giannotta, MD

Professor
Dept of Neurological Surgery
Keck School of Medicine of USC

Dr. Steven Giannotta, Professor of Neurological Surgery, joined the Department of Neurosurgery at USC in 1980. He served as Department Chair for 20 years from 2004-2024. He earned his medical degree from the University of Michigan, where he also did his neurosurgical residency. He has been involved in many local, national and international committees and organizations. His involvement on the national level began with the Congress of Neurological Surgeons serving on multiple committees. He was the CNS Annual Meeting Chair in 1985, Editor of the CNS Newsletter from 1983-1986, Secretary from 1986-1989 and Vice President from 1992-1993. He continued to serve in the CNS with roles as the Future Sites Chair from 1990-1994, Chair of the International Committee from 1992-1994 and Nominating Committee from 1996-1999. Dr. Giannotta received the CNS Distinguished Service Award in 1995, was the Drake Lecturer in 2005, received the Founders Laurel Award in 2017, and was the Honored Guest at the CNS Annual meeting in 2024.

Dr. Giannotta also held many other leadership roles in organized neurosurgery. He was on the Board of Directors of the Joint Section of Cerebrovascular Surgery of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons from 1987-2000 and was Chair from 1996 until 1998. He remained on the Senior Advisory Board for many years and received the JSCVS Distinguished Service Award in 2004. He also served on many Committees of the American Association of Neurological Surgeons including the Scientific Program Committee from 1996-1999, Annual Meeting Chair in 2000, Board of Directors from 2001-2004, and Professional Conduct Committee from 2005-2011. He was President of the American Academy of Neurological Surgeons from 2009-2010 and was Vice President of the Society of Neurological Surgeons from 2010-11.

In addition to national societies, Dr. Giannotta was actively involved in the education, certification and accreditation processes for neurosurgery. He was a Director of the American Board of Neurological Surgery from 1996-2001. After completing a term as Secretary from 1999-2000, he was Chair of the ABNS from 2000-2001. From 2002-2008 he completed a six-year term on the Residency Review Committee for Neurosurgery (ACGME), the last two as Chair of the Committee. From 2008-2018 he served as the Secretary of the Committee on Advanced Subspecialty Training (CAST) for the Society of Neurological Surgeons accrediting Neurosurgery fellowship training programs. He was the Program Director at the Los Angeles General Medical Center (Previously LAC+USC Medical Center)/University of Southern California Neurosurgery Residency Program from 2004-2023 and is currently continuing to support the residents and training program, especially through active teaching in the operating room at LAGMC.

He has special clinical interests and expertise in two broad areas of neurological surgery. Dr. Giannotta has gained recognition for his work in cerebrovascular disease of the brain and spinal cord. He has surgically treated over 3000 intracranial aneurysms. Dr. Giannotta also has an interest and special expertise in surgical approaches to the cranial base. He has surgically removed more than 1000 acoustic neuromas and along with several colleagues in otolaryngology has developed a team approach to complex cranial base lesions including acoustic neuromas, meningiomas of the cranial base, complex aneurysms that require cranial base approaches and other benign conditions affecting the base of the brain and skull. Since 1992 he has developed one of the largest practices for the surgical treatment of trigeminal neuralgia.

Shoshone Falls near Twin Falls, drops 52 feet further than Niagara Falls

Prior Cloward Award Recipients

2003 George Ojemann, MD "Investigating Human Cognition during Epilepsy Surgery"

2005 Donald Prolo, MD *"Legacy Giants in the Treatment of Spinal Disorders: Ralph Cloward and Marshall Urist"*

2006 Martin Weiss, MD *"A Historical Walk through Pituitary Surgery"*

2007 Charles Wilson, MD *"The Future of Neuroscience"*

2008 Peter Jannetta, MD *"Vascular Compression in the Brainstem: Main Streaming Neurosurgery"*

2009 L. Nelson Hopkins, MD *"Neurosurgeons and Stroke: From Prevention to Treatment"*

2010 Sean Mullan, MD *"Some Neurosurgical Fossils"*

2011 John A. Jane, Sr., MD, PhD *"Anterior vs Posterior Approaches to the Cervical Spine"*

2012 John R. Adler, Jr., MD *"Stepping- Out of the OR: A Surgeon's Foray into Entrepreneurship"*

2014 Andres M. Lozano, MD *"Taming Dysfunctional Brain Circuits"*

2015 Edward Oldfield, MD *"The origin of concepts in neurosurgery: One neurosurgeon's perspective"*

2016 Donald P. Becker, MD ***"****Brain Trauma and Beyond: A Career in Neurosurgery"*

2017 Volker K.H. Sonntag, MD *"The Journey of Spinal Neurosurgery in the United States"*

2018 Edward R. Laws, Jr., MD *"Virtuosity in Surgery and Neurosurgery"*

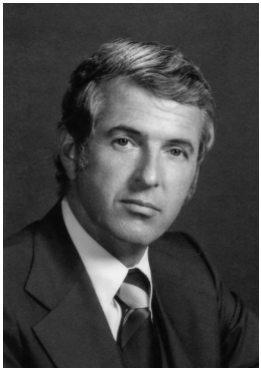
2019 Robert F. Spetzler, MD *"My Journey in Neurosurgery"*

2021 Richard Ellenbogen, MD *"The Myth of Equipoise"*

2022 Gary K Steinberg, MD, PhD *"A Life Odyssey to Understand and Treat Cerebrovascular Disease, with a Few Detours"*

2023 Mitchel S. Berger, MD Professor of Neurosurgery, University of California, San Francisco

2024 Linda M. Liau, MD, PhD *"From Drop to Ocean: 30 yrs in Neurosurgical Oncology"*



Randy Smith Lectureship

Randall W. Smith, Randy to all of us, was our organization's most influential and effective leader for over a generation. He was the mainstay of the Executive Committee.

Randy served the Western Neurosurgical Society in every possible capacity. In particular, he played three important roles. After serving as Secretary/Treasurer for three years, he left a"how-to" manual with a detailed timeline for duties and responsibilities. As Historian, he digitized our annual booklet programs and photos from the past, much to the enjoyment of members at our formal banquet. He started the tradition of publishing a newsletter so members and their families could anticipate the activities of the next annual meeting.

Randy was a Renaissance man. His interests were varied and extended beyond neurosurgery, though his commitment to organized neurosurgery was unwavering. He enjoyed classical music, and sports of all kinds – he had a fantastic memory of various critical plays in baseball and football, farming/ ranching –enjoyed his beloved (and producing!) avocado ranch, woodworking – leaving examples of perfection and beauty; philanthropy, reading and writing. He relished having a drink with members after a board meeting and before a reception. He was a friend and a mentor to his colleagues at the "Western" and beyond. He was very inquisitive and taught by example. He encouraged us to lead a balanced life.

He was the "Conscience" of the Western Neurosurgical Society and will be greatly missed by all.

Randy was also a mentor to many of us. He loved the Western and, in so many ways, enhanced the experience we all enjoy at our annual meetings.

Prior Randy Smith Lecturers

2023	Katie O'Meara Orrico, Esq. Senior Vice President, Health Policy & Advocacy American Association of Neurological Surgeons (AANS) and Congress of Neurological Surgeons (CNS)
2024	Nuvi Mehta San Diego Symphony, Special Project Director

On October 25, 2021, we mourned Randy's passing.

To honor his memory, the Executive Committee established the Randy Smith Lectureship.

The committee envisions annual lectures given by speakers who reflect Randy's vision of a wide range of interests in medicine and the humanities, such as music, philanthropy, hobbies, extracurricular activities, leading a balanced life, leadership, and mentorship. The Awards Committee will select speakers and presentations for the annual meetings.

We have asked all WNS members to donate generously to the Randy Smith lectureship; we believe each member will enjoy the lectures, and the WNS as a whole will benefit from the lectureship.

We are happy to announce at the 2024 annual meeting that thanks to your generosity we have reached our $100,000 goal for the Randy Smith Lectureship! Additional donations will go towards the **WNS Development Fund** in Randy's honor.

If you would like to make a donation please fill in the information below, tear it out of the booklet and return to the registration desk or directly to WNS Secretary-Treasurer.

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Thank you in advance for your donation!

The Western Neurosurgical Society is a 501(c)(3) not for profit organization and all donors will receive a tax exempt donation receipt for tax purposes.

Please make your checks payable to the Western Neurosurgical Society. In the memo line, please write Randy Smith Lectureship.

If you prefer to mail your check, please send to:

J. Adair Prall, MD, Secretary/Treasurer
Western Neurosurgical Society
7780 South Broadway, Suite 350
Littleton, CO 80122

2025 Randy Smith Lecturer

Karin Muraszko, MD
Julian T. Hoff Professor and Chair
University of Michigan

Karin M. Muraszko was born and raised in New Jersey. She was educated at Yale University, having received a B.S. with a double major in history and biology. She is a graduate from Columbia College of Physicians and Surgeons. She did her internship, neurosurgical training, and pediatric neurosurgical training at Columbia Presbyterian Medical Center-the New York Neurological Institute, and then became a Senior Staff Fellow at the National Institutes of Health-NINDS in the Surgical Neurology Branch.

Dr. Muraszko arrived at the University of Michigan in 1990. She became Chief of the Pediatric Neurosurgery Service in 1995, and became Chair of the Department of Neurosurgery in January of 2005, becoming the Julian T. Hoff Professor of Neurosurgery in 2006. She is a Professor in the Department of Neurosurgery with joint appointments in Plastic Surgery and Pediatrics, and is the first woman to chair an academic neurosurgical department in the United States. She completed her term as Chair in 2022.
She has served on numerous committees within the CNS, AANS, ACS, the Pediatric Section of the AANS, the American Society of Pediatric Neurosurgery, as well as having been a Director of the American Board of Neurological Surgeons. Dr. Muraszko was a member of the ACGME's Neurosurgical Residency Review Committee (RRC) and was selected as a member of the RRC's Executive Committee. She continues to serve on the Executive Committee of Women in Neurosurgery. She serves as a Director of the American Board of Pediatric Neurosurgery and continues her role as an examiner for the ABNS/ABPNS. She was elected Vice Chair of the UMHS Hospital Executive Board and has served as Chair of the U-M Children & Women's Executive Committee, and on the Physician's Advisory Committee of the Spina Bifida Association and the March of Dimes. Dr. Muraszko is also honored to be the first woman appointed as a Director of the American Board of Neurological Surgeons and the Neurosurgery Resident Review Committee of the ACGME, as well as the first woman to serve as President of the SNS (2019-2020). She was inducted into the National Academy of Medicine in 2020 and serves as the Chair of the Research Advisory Board of the Pediatric Brain Tumor Foundation.
She has received numerous awards including: the Association of Women Surgeons and American College of Surgeons Nina Starr Braunwald Award, American Medical Association Inspirational Physician Award, Spina Bifida Association Outstanding Medical Professional Award, the American Health

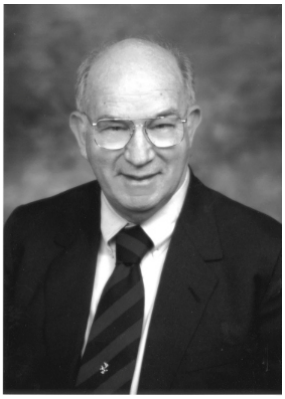
Council Best in Healthcare Award, the Castle Connoly Exceptional Women in Medicine and Top Doctors Award, the Congress Neurological Surgeons Distinguished Service Award, the American Association of Neurological Surgeons Humanitarian Award, and the University of Michigan: Community Service Award, the Sarah Goddard Power Award, the Harold R. Johnson Diversity Service Award, Gender Equity Award of the U of M American Medical Women's Association, the Women in Academic Medicine Impact Award (renamed the Karin M. Muraszko for the Advancement of Women in Academic Medicine Award), the Columbia College of Physicians and Surgeons 2024 Virginia Kneeland Frantz '22 Award for Distinguished Women in Medicine and the Henry Russel Lecturer (University's highest honor for a senior member of its active faculty).

Dr. Muraszko's research interests include experimental therapies for the treatment of pediatric brain tumors, the treatment and diagnosis of Chiari malformations and other congenital anomalies of the spine and brain, and the treatment of children with complex craniofacial anomalies. She is director of the Pediatric Brain Tumor Clinic at the University of Michigan Rogel Comprehensive Cancer Center, and has worked to develop new therapies for brain tumors. She is on the Executive and Scientific Advisory Committee of the Chad Carr Pediatric Brain Tumor Institue and is on the Executive Committee of the Pediatric Brain Tumor Foundation. She is the co-founder of Project Shunt at the University of Michigan. This is a program that provided care to indigent children in Guatemala and was a yearly medical mission of neurosurgeons, anesthesiologists, neurosurgical residents, and nursing staff from the University of Michigan, under her direction since 1998. Her various research projects have contributed to her authorship of over 200 peer reviewed publications, as well as numerous book chapters, 3 books and many non-peer reviewed publications and media posts.

Dr. Muraszko is married to Scott VanSweringen, an architect, and they have two wonderful children, Paxton and Alexandria. They enjoy traveling, fishing, and architectural conservation.

Coeur d'Alene lake is a glacier-formed lake and spans 25 miles in length and reaches a width of 10 miles at its widest point

George Ablin



1923-1999

In 2000, the members of the Western Neurosurgical Society inaugurated a new lectureship designed to honor, in a tangible and enduring manner, one of the Society's most outstanding members. In its long history, the Society has had no more devoted contributor than Dr. George Ablin. He brought to the group stunning ability and experience, especially in matters of local, national, and international organization, in which he had few peers.

He contributed through service in many areas including a memorable term as President. He was a wise and thoughtful counselor whose advice concerning many professional and personal questions always included a careful analysis, given with words of encouragement.

There was no more active and engaged participant in all of the Society's affairs.

George Ablin was raised in Chicago, received his BS and MD from the University of Michigan, interned at Charity Hospital, New Orleans, Louisiana, did his residency at the University of Wisconsin, later was Instructor at the University of Michigan, and also became a Clinical Professor at California State University, Bakersfield. Dr Ablin was Board Certified in Neurological Surgery, a Fellow of the American College of Surgeons, and a Diplomat of the National Board of Medical Examiners.

Dr Ablin began practice in neurosurgery in Bakersfield, California, in 1953, was President of the Kern County Medical Society in 1984, and was very active in the California Medical Association in various leadership positions. He was Treasurer of the California Medical Review Board and received Distinguished Service awards from the Congress of Neurological Surgeons and the American Association of Neurological Surgeons. He was named Honorary President of the World Neurological Society and in 1989 he was selected as the Kern County Physician of the Year. George was the devoted father of seven children, three of whom became physicians.

George combined an exceptionally perceptive understanding of others, including hundreds of fellow neurosurgeons, with warmth and gentleness and lively humor. He loved his colleagues and friends, and he loved this Society. With this permanent lectureship, the members of the Western Neurosurgical Society honor George Ablin and his cherished wife, Millie.

The Randy Smith Lectureship will replace the Ablin Lecture Series.
This was respectfully discussed with and agreed upon by the Ablin family.

Prior Ablin Lectures

2000 Arthur L. Day, MD, Professor of Neurosurgery, University of Florida. *"Unruptured Intracranial Aneurysms and Sports Medicine in Neurosurgery"*

2002 Tom Campbell, JD, PhD, Professor of Law, Stanford University. Former Congressman. *"Is Freedom Possible in Medicine"*

2003 Frederic H. Chaffee, PhD, Director, WM Keck Observatory, Hawaii. *"The WM Keck Observatory at the Dawn of the New Millennium"*

2004 Gerald Kooyman, PhD, Research Professor, Scripps Institute of Oceanography, San Diego. *"Emperor Penguins: Life at the Limits"*

2005 Lt. Col. Rocco Armonda, MD, Neurological Surgeon, U.S. Army Bethesda, Maryland. *"The Modern Management of Combat Neurotrauma Injuries: Battlefield to the Medical Center"*

2006 August Turak, Spiritual and Business Consultant. *"Spirituality and the Neurosurgeon"*

2007 Donald Trunkey, MD, Internationally Renowned Trauma Surgeon. *"The Crisis in Surgery with Particular Emphasis on Trauma"*

2008 Michael Bliss, PhD, Emeritus Professor, University of Toronto. *"Working Too Hard and Achieving Too Much? The Cost of Being Harvey Cushing"*

2009 Michael A. DeGeorgia, MD, Professor of Neurology. Case Western Reserve University, Cleveland, Ohio. *"Struck Down: The Collision of Stroke and World History"*

2010 Chris Wood, PhD, Vice President for Administration, Santa Fe Institute. *"What Kind of Computer Is The Brain?"*

2011 Volker Sonntag, MD, Vice Chairman, Division of Neurological Surgery Barrow Neurological Institute, Phoenix, Arizona. *"Cervical Instrumentation: Past, Present & Future"*

2012 Robert Schrier, MD, Professor of Medicine, University of Colorado. *"Illnesses in the US Presidents in the 20th Century: Potential Impact on History"*

2013 Samuel Eric Wilson, MD, Professor, Department of Surgery, University of California, Irvine. *"Between Scylla and Charybdis: Can Academic Surgery Survive?"*

2014 Jon H. Robertson, MD, Professor of Neurosurgery, University of Tennessee. *"The challenge of the Future Neurosurgical Education"*

2015 David Piepgras, MD, Professor of Neurosurgery, Mayo Clinic. *"Frontier Surgery: Lessons for Today from Beaumont and St. Martin"*

2016 Larry R. Squire, Ph.D. Professor of Psychiatry, Neurosciences & Psychology, UCSD. **"***The Legacy of Patient H.M. – Cognitive Neuroscience of Human Memory"*

2017 Lucy Kalanithi, MD, FACP Assistant Clinical Professor, Stanford University. *"When Breath Becomes Air-A Conversation with Lucy Kalanithi"*

2018 Michael Edwards, MD, Professor of Neurosurgery, Stanford "*40 years of Pediatric Neurosurgery: The impact of Moore's Law"*

2019 Regis Haid, MD, Professor of Neurosurgery, Emory University, Atlanta, GA *"Spinal Alignment: Keys to the Kingdom"*

Local Interest Lecturer

Jim States, MD

Dr Jim States practiced Adolescent and Young Adult Medicine/Family Medicine until 2017. Prior to retirement, he was dual board certified in Family Medicine & Adolescent Medicine, and provided consultation to rural Tribal Health Clinics in Washington regarding the complex medical-psychological disorders of high risk youth and adults.

Since retiring you can find him either volunteering with Kitsap County Department of Emergency Management or Mason County Department of Emergency Medicine. You may also find him sailing as many winter storms as possible in Puget Sound.

He has sailed 20,000 nautical miles in a 24' Pacific Seacraft on BC Coast to Alaska.

He has extensive experience climbing at high altitude, including expeditions to South America, Mt McKinley, Nanda Devi, Makalu and Everest. Everest Summit photos he took were purchased/published in video documentary by National Geographic.

Dr. States has over 22 years of high altitude experience: approximately 10+ months above 17,000', two months over 22,000' 1.5 weeks over 25,000' and 5 days between 26,600' and 29,028'.

He brings his expedition and austere medicine experience into his work in Disaster Preparedness for Mason & Kitsap counties. He applies the lessons of energy utilization and conservation necessary for sailing & high altitude climbing to Disaster Readiness where resources are limited.

Coeur d'Alene has one sister city: Cranbrook, British Columbia in Canada

2025 Scientific Program

Coeur d'Alene, Idaho | September 11-14th, 2025
71st Annual Meeting

The Changing Landscape of Neurosurgery:
Honoring Firsts, Shaping Futures

Friday, September 12, 2025

6:30am - 7:45am	**Breakfast with Exhibitors**
7:45am - 8:00am	**Presidential Welcome** - Odette Harris, MD, MPH
8:00am - 9:00am	**Scientific Session I - Pediatric/General Neurosurgery** *Moderators:* Laura Prolo and David Gonda

- 10 min talks 5 min discussion

Craig Kilburg	*Transcirculatory approach for delivery of intraarterial chemotherapy agents in pediatric patients with retinoblastoma: a case series.*
Julie G. Pilitsis	*Coccidioidomycosis-Related Hydrocephalus: CSF Profiles and Shunt Outcomes in a Retrospective Cohort*
Andrew Little	*Multicenter United States Craniopharyngioma Research Consortium: Insights and Future Directions into Treatment of Craniopharygioma*
Anthony DiGiorgio	*Interfacility Transfer Patterns of Traumatic Brain Injury Patients: A Comparison Between Uninsured and Insured Individuals in California Between 2017-2019*

9:00am - 9:45am	**Local Interest Lecture**: Jim States, MD *Everest: Lessons of Endurance* (Introduction by William Ganz)
9:45am - 10:15am	**Break with Exhibitors**
10:15am - 11:15am	**Scientific Session II - Vascular / Tumor** *Moderators:* Justin Dye and Geoff Colby

- 15 min talks 5 min discussion

Karol P Budohoski	*Endoluminal Biopsy Identifies SP 100 as a Potential Driver of Endothelial Dysfuntion in Aneurysmal Subarachnoid Hemorrhage*
Jeffrey Steinberg	*Predictors of Residual Arteriovenous Malformation on Intraoperative and Postoperative Angiograms Following Resection*
Gary K Steinberg	*Microsurgical Resection of Eloquent Brain AVMs*

11:15am - 12:00pm	**Cloward Award Lecture**: Steven Giannotta, MD (Introduction by Alexander Khalessi)

Saturday, September 13, 2025

6:30am - 7:55am	**Breakfast with Exhibitors**
6:00am - 7:55am	**Members Business Meeting**
8:00am - 8:45am	**Randy Smith Lecture**: Karin Muraszko, MD (Introduction by Deborah C. Henry)
8:45am - 9:15am	**Panel Discussion with Women Leaders in Neurosurgery: Honoring Firsts, Shaping Futures** *Moderator:* Sharona Ben-Haim Panelists: Karin Muraszko, Julie Pilitsis, Odette Harris
9:15am - 9:45am	**Resident Award Presentations** (Introduction by Sharona Ben-Haim)
Shivani Baisiwala	**Clinical Science Award Winner** *Developing an Autologous Human Tumor-Immune Organoid Model for Glioblastoma*
Anthony Lee	**Basic Science Award Winner** *Region-specific Functional Cytoarchitecture in Human Superior Temporal Gyrus Underlie Divergence in Language Processing and Autism*
9:45am - 10:15am	**Break with Exhibitors**
10:15am - 10:45am	**Scientific Session III - Resident Rapid Fire Abstracts** *Moderators:* Ciara Harraher and Anthony DiGiorgio

- 7 min talks 3 min questions/transition

Lily Kim	*Glycolysis-Cholesterol Metabolism Crosstalk in Glioblastoma: Disruption of Lipid-Rich Membrane Domains as a Metabolic Vulnerability of Pro-tumoral Myeloid Cells*
Khadija Soufi	*Enhanced Measures to Quantify Gait and Balance Impairment in Degenerative Cervical Myelopathy: A Prospective Cohort Study*
Steve S. Cho	*Early Follow-Up Results in Patients Undergoing Uniportal Full Endoscopic Cervical Unilateral Laminectomy and Bilateral Decompression*
10:45am - 11:15am	**The Future of Neurosurgery**: Resident Panel Moderator: Ciarra Harraher
11:15am - 12:00pm	**Presidential Address:** Odette Harris, MD, MPH (Introduction by Robert Dodd, MD, PhD) ***The Changing Landscape of Neurosurgery: Honoring Firsts, Shaping Futures***

Sunday, September 14, 2025

6:30am - 8:00am	**Breakfast with Exhibitors**
8:00am - 9:30am	**Scientific Session IV - Spine Surgery** *Moderator:* Rich Chua

- 10 min talks 5 min discussion

Jared Ament	*The First Grade III Lumbar Spondyliolisthesis Treated with The Novel 360-Degree Artificial Disc/Artificial Facet Replacement (ADR/TOPS) Solution*
Nathan Han	*Does Velocity of Return-to-Work Differ between Circumferential Minimally-Invasive and Open Surgery to Treat Adult Spinal Deformity?*
Ali Ravanpay	*Radiographic Cervical Spine Volumetric Tissue Loss and Delayed Neurological Decline After Spinal Cord Injury*
Bruce McCormack	*Safety Outcomes Following Circumferential Cervical Fusion with an Investigational PCF Device Compared to ACDF alone: Results from 227 Prospectively Enrolled Subjects with 3-level Disease*
Patrick Johnson	*24 Years Experience of Artificial Disc Replacement (ADR) and Where We Are (hopefully…) and should be going!*
Martin Pham	*Robot-Assisted Cervical Pedicle Screw Placement: Case Series and Technical Description*
9:30am - 10:00am	**Break with Exhibitors**
10:00am - 10:45am	**Prolo Lecture:** Jonathan Chen, MD, PhD (Introduction by Marco Lee) *AI in Medicine: Integrated Intelligence or Illusory Imitation?*
10:45am - 11:45am	**Scientific Session V - Functional** *Moderator:* Brian Lee and Moustapha AbouSamra

- 15 min talks 5 min discussion

Shervin Rahimpour	*Thalamotomy for Facial and Non-Facial Neuropathic Pain*
Andrew Yang	*Towards Personalized, Precision Neuromodulation in Drug-Resistant Epilepsy: Single-Center experience in Thalamicstereo EEG*
David Caldwell	*Intraoperative Electrocorticography Guided Resection in Patients with Seizures Associated with Cerebral Cavernous Malformations*
11:45am - 12:00pm	**2026 Meeting Update**: Adair Prall **Closing Remarks**: Odette Harris

Friday, September 12, 2025
Scientific Session I

Pediatric / General Neurosurgery

Transcirculatory approach for delivery of intraarterial chemotherapy agents in pediatric patients with retinoblastoma: a case series

Craig Kilburg, MD, Department of Neurosurgery, Clinical Neurosciences Center, University of Utah, Salt Lake City, Utah

Sam A. Tenhoeve, BA[1,2], Sarah Nguyen, MD[2], Caroline M. Craven, MD[3], Eric D. Hansen, MD[3], Matthew S. Dietz, DO, MSEd[4], Casey Mehrhoff, DO[4], G. Peter Feola, MD[5], Craig Kilburg, MD[2]

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Introduction: Intraarterial chemotherapy (IAC) via the ophthalmic artery (OA) is a known treatment for retinoblastoma. Traditional access through the ipsilateral internal carotid artery (ICA) can result in suboptimal chemotherapy delivery if OA cannulation is difficult. As an alternative, transcirculatory approaches, which are typically only used for salvage, may provide more complete chemotherapy delivery. We evaluated the safety, feasibility, and efficiency of transcirculatory IAC.

Methods: We retrospectively reviewed pediatric patients undergoing transcirculatory IAC at our institution from January 1, 2024, to January 31, 2025. This timeframe marks a shift toward using transcirculatory access initially rather than as a salvage approach. The data include two patient groups: one comprising patients converted to a transcirculatory approach intraprocedurally (salvage) after initial ipsilateral approach failure and one comprising patients who underwent transcirculatory approaches alone. Most patients in both groups had previously undergone ipsilateral-only approaches during prior IAC treatments. The data from those approaches were used for comparison with the transcirculatory approaches. Patients who only underwent ipsilateral approaches for all IAC treatments were excluded. Demographic data, procedural details, contrast leakage rates from the OA, and intraoperative complications were analyzed.

Results: Eight pediatric patients underwent 34 IAC treatments, including 19 ipsilateral ICA access approaches and 15 transcirculatory approaches (11 as the initial approach and 4 as salvage). There were no significant differences in procedure times between transcirculatory and ipsilateral ICA approaches (150.9±2.3 vs. 166.4±29.2 min, respectively, p=0.17) or fluoroscopy times (12.4±5.6 vs. 11.0±5.6 min, respectively, p=0.56) when transcirculatory access was used as the initial approach. Neither group experienced intraoperative complications. Contrast leakage from the OA was documented in 4 patients during transcirculatory access and 12 patients during ipsilateral access approaches (p=0.16).

Conclusion: Primary transcirculatory approaches for IAC in pediatric patients with retinoblastoma are technically feasible, safe, and comparable with ipsilateral ICA access.

Coccidioidomycosis-Related Hydrocephalus: CSF Profiles and Shunt Outcomes in a Retrospective Cohort

Dr. Julie G. Pilitsis, MD PhD MBA
Chair of the Department of Neurosurgery at the University of Arizona Tucson

Pravarakhya Pupppalla BA, Derek Smetanick MS, Sameena Rahman MS MPH, Avantika Mitbander BS, Dara Sam Farhadi MD MS, Julie G. Pilitsis MD PhD MBA
All are affiliated with the Department of Neurosurgery, University of Arizona Tucson

Objective: We compared 7-year outcomes between patients who underwent shunting with and without coccidioidomycosis (CM).

Introduction: Coccidioidomycosis (Valley Fever) is a fungal infection endemic to the southwestern United States.[1] Meningitis occurs in approximately 1% of cases and often results in hydrocephalus necessitating shunting and lifelong antifungal therapy.[2–3] The only large series of patients was reported prior to the widespread use of programmable valves, anti-microbial catheters, and newer antifungal agents.[4]

Methods: We identified all neurosurgical patients who underwent shunt placement for hydrocephalus between 2017 and 2024 at the University of Arizona Tucson. Patients were grouped based on confirmed CM status. Demographics, shunt characteristics, failure rates, imaging findings, operative complications, and mortality were compared.

Results: Of 256 patients, 21 had CM. The mean number of shunting procedures at approximately 1 year was 1.62 ± 0.22 (SEM) for patients with CM compared to 1.75 ± 0.07 for those without ($p=0.58$). Initial shunting was more commonly done at our facility for patients with CM ($p=0.04$). There were no differences in age ($p=0.78$), sex ($p=0.67$), or race ($p=0.73$). Among patients with CM, 19.0% lived in rural areas compared to 10% without CM ($p=0.21$). Higher lymphocyte counts, lower glucose, and lower monocyte counts were seen in CM patients ($p<0.01$). Patients with CM had lower rates of GI (47.6% vs 70.6%, $p=0.03$) and neurologic (42.8% vs 65.1%, $p=0.04$) comorbidities. Mean CSF protein levels were 129 ± 22.8 mg/dl without CM and 105 ± 33.6 mg/dl with CM ($p=0.55$).

Conclusions: Treatment of coccidioidomycosis-related hydrocephalus most commonly occurs in the Southwest. Despite infection risks, advances in shunt technology and antifungal therapy likely contribute to similar short-term shunt revision rates compared to controls. Differences in lymphocyte and monocyte counts suggest some underlying immunologic differences, but CSF protein levels and outcomes were comparable.

Multicenter United States Craniopharyngioma Research Consortium: Insights and Future Directions into Treatment of Craniopharygioma

Andrew S. Little, MD, MBA, Barrow Neurological Institute, Phoenix, AZ

On behalf the RAPID Consortium

Introduction: The major limitations of research into craniopharyngiomas include its rarity, which reduces statistical power; the predominance of single-center series, which limit generalizability; and the differing treatment philosophies across centers, which makes rigorous comparisons between treatment strategies difficult. The Registry for Adenomas of the Pituitary and Related Disorders (RAPID) was founded to address the need for a multicenter pituitary and neuro-endocrine tumor research consortium in the United States. We present the results of this craniopharyngioma collaboration, which includes several institutions represented in the WNS.

Methods: The craniopharygioma effort launched in early 2024. The steering committee developed a project roadmap to address some of the most intriguing questions across 4 key domains of surgical outcomes, metabolic and endocrine outcomes, imaging, and treatment trends. We are tracking demographics, surgical details, complications, adjunctive treatments, pathology and imaging findings, and endocrine outcomes.

Results: To date, more than 600 adult and pediatric patients treated by 30 surgeons of differing levels of experience at 14 US centers have been enrolled. Of these, 110 patients were diagnosed with papillary craniopharyngioma, representing one of largest datasets available for analysis of this uncommon tumor subtype. Data analysis and manuscript preparation are underway for surgical outcomes, racial disparities, surgeon experience, metabolic outcomes, and treatment trends. Multicenter image sharing designed to enable radiomics studies was launched April 1, 2025. Eight manuscripts are in preparation.

Conclusions: The craniopharyngioma module from the RAPID Consortium is a unique US scientific resource that is advancing standard of care for patients. This year, the collaboration is growing to 20 centers. Complementing this outcomes effort is the creation of a clinically annotated living tissue biobank.

The name, “Coeur d’Alene”, was given to the tribe by French traders and trappers. In French, it means “Heart of the Awl,” referring to the savvy and sharp trading skills exhibited by tribal members

Interfacility Transfer Patterns of Traumatic Brain Injury Patients: A Comparison Between Uninsured and Insured Individuals in California Between 2017-2019

Anthony DiGiorgio, DO, MHA
University of California, San Francisco

Hayley Granberg, BA[1], Blake Taylor, MD[2]; John Yue, MD[2-4]; Andrew Shermeyer, MPA[5]; Sayeh Nikpay, PhD[5]; Geoff Manley, MD, PhD[2-4]; Renee Hsia, MD[5,6]; Michael Ward, MD, PhD, MBA[7-9];Anthony DiGiorgio, DO[2-4]

[1]Rocky Vista University College of Osteopathic Medicine, Parker, Colorado [2]Department of Neurosurgery, UCSF, [3]Philip R. Lee Institute for Health Policy Studies, UCSF, [4]Brain and Spinal Injury Center, Zuckerberg San Francisco General Hospital, San Francisco, CA, [5]Division of Health Policy and Management, University of Minnesota School of Public Health, Minneapolis, MN, [6]Department of Emergency Medicine, UCSF, [7]Department of Emergency Medicine, Vanderbilt University Medical Center, Nashville, TN [8]Department of Biomedical Informatics, Vanderbilt University Medical Center, Nashville, TN, [9]Geriatric Research, Education, and Clinical Center, Tennessee Valley Healthcare System, Nashville, TN

Introduction: Traumatic brain injury (TBI) is a leading cause of disability in the United States with TBI-related fatalities increasing by 13.3% from 2019-2023. While the Emergency Treatment and Labor Act (EMTALA) of 1986 mandates care for patients regardless of payment ability, non-medical factors like insurance status may influence interfacility transfer. We aimed to explore the impact of insurance status and hospital ownership on the likelihood of interfacility transfer for patients with TBI upon arrival to the Emergency Department (ED).

Methods: Traumatic brain injury (TBI) is a leading cause of disability in the United States with TBI-related fatalities increasing by 13.3% from 2019-2023. While the Emergency Treatment and Labor Act (EMTALA) of 1986 mandates care for patients regardless of payment ability, non-medical factors like insurance status may influence interfacility transfer. We aimed to explore the impact of insurance status and hospital ownership on the likelihood of interfacility transfer for patients with TBI upon arrival to the Emergency Department (ED).

Results: Initial results showed that, after adjusting for confounders, insured patients at public hospitals had significantly higher odds of transfer than underinsured patients at public hospitals (OR 1.57, 95% CI 1.07-2.29, p = 0.02). Conversely, at private hospitals, neither insured or underinsured patients had significantly different transfer odds compared to underinsured patients at public hospitals (OR 1.53, 95% CI, 0.92-2.55, p=0.100; OR 1.45, 95% CI 0.86-2.47, p=0.165, respectively). However, further analysis excluded patients who were insured by a single large Health Maintenance Organization (HMO) in California, which tends to repatriate its beneficiaries from the emergency department. This modeling demonstrated no effect of insurance status on the likelihood of transfer (OR 1.44, 95% CI 0.86-2.41, p=0.85).

Conclusions: Insurance status does not affect the likelihood of transfer for patients presenting with traumatic brain injury to hospitals with neurosurgical coverage.

Friday, September 12, 2025
Scientific Session II

Vascular / Tumor

Endoluminal Biopsy Identifies SP100 As A Potential Driver Of Endothelial Dysfunction In Aneurysmal Subarachnoid Hemorrhage

Karol P Budohoski, MD, PhD
Department of Neurosurgery, University of Utah

Leo Kim, MD, PhD; Sarah Dabb, BS; Allison Liang, MD, MS; Robert C. Rennert, MD; Craig J. Kilburg, MD; Ramesh Grandhi, MD; Karol P. Budohoski, MD, PhD

Introduction: neurysmal subarachnoid hemorrhage (aSAH) is a devastating neurological condition associated with a 30-40% case fatality rate. Although advances in aneurysm treatment have led to improved outcomes, secondary injury, e.g. delayed cerebral ischemia (DCI), often leads to neurological morbidity. Several proposed mechanisms of DCI converge on endothelial cell (EC) dysfunction. Endoluminal biopsy provides longitudinal, minimally invasive opportunities to study EC dysfunction. Here we leveraged endoluminal biopsies of ECs from ruptured and unruptured intracranial aneurysm patients with single-cell RNA sequencing (scRNA-seq) to identify SP100 nuclear antigen (SP100) as a potential driver of EC dysfunction.

Methods: We biopsied ECs from the access arterial vessels and intracerebral aneurysms during endovascular procedures performed in 10 patients (4 ruptured, 6 unruptured). From these specimens, 1,519 cells were sorted through flow cytometry for scRNA-seq profiling. 525 cells had enough transcriptomic read depth (greater than 100 detectable genes with at least 1/100,000 reads) to perform downstream analysis.

Results: Uniform manifold approximation and projection (UMAP) analysis demonstrated three distinct EC clusters. Ruptured aneurysm-specific ECs enriched in cluster 2, while other clusters had similar representations of access arterial vessel vs. aneurysmal ECs. In cluster analysis, we identified SP100 as one of the most enriched genes in ruptured aneurysmal ECs. To identify up-stream regulators of SP100 in ECs, we examined the regulatory elements in SP100 locus. We found multiple interferon-response factor (IRF)-binding sites. We verified the up-regulation of SP100 in intracranial aneurysm bulk RNA-seq dataset and strong correlations between type I interferon response and SP100 expression level.

Conclusions: ECs from ruptured aneurysm represent a distinct subpopulation of ECs compared to patient-matched access vessels and are enriched in SP100 expression. The pro-inflammatory microenvironment within ruptured aneurysms may upregulate SP100 expression ECs, leading to migratory and homeostatic dysfunction, and may be a druggable target to limit secondary neurologic injuries from aSAH.

Predictors of Residual Arteriovenous Malformation on Intraoperative and Postoperative Angiograms Following Resection

Jeff Steinberg, MD
UCSD Neurosurgery

Michael G. Brandel, Arvin R. Wali, J. Scott Pannell, David R. Santiago-Dieppa, Michael L. Levy, Alexander A. Khalessi, Jeffrey A. Steinberg

Introduction: Digital subtraction angiography (DSA) remains the gold standard for intraoperative evaluation of residual arteriovenous malformations (AVMs) during open surgical interventions. Certain AVM characteristics may predict the presence of residual on intraoperative and postoperative DSA.

Methods: We retrospectively reviewed the charts of pediatric and adult patients who underwent craniotomy for AVMs by the senior author, a dual-trained neurosurgeon, from 2021-2025. Our standard approach for AVM surgery involves an intraoperative DSA, as well as a delayed postoperative DSA when possible. Only cases with intraoperative DSA were included for analysis. AV fistulas were excluded.

Results: Twenty-six patients met inclusion criteria. Median age was 17 (interquartile range 13-37) years (15 children and 11 adults). Four (15%) were diffuse AVMs and 42% had deep venous drainage; of the diffuse AVMs, 3 (75%) had deep venous drainage. Residual nidus or vein was identified on 5 (19%) intraoperative DSAs, which then required further resection, with no angiographic residual lesion present at the conclusion of the procedures. 85% of patients underwent a formal follow-up DSA. Only one patient (5%) had residual lesion on short-interval follow-up angiogram. However, two patients (10%) who had clean early postoperative DSAs had recurrence on delayed angiography. However, each of these recurrences were too small and distal to be targets for embolization, and both have been surveilled. Only one of the five (20%) patients who required further resection developed a delayed recurrence; this was a diffuse, multifocal AVM.
On multivariable analysis, diffuse AVMs were associated with residual on intraop DSA (odds ratio [OR]=30, 95% confidence interval [CI] 2-517, p=0.020). There was no significant association with deep venous drainage (p>0.05).
Diffuse AVMs were associated with recurrence on postop DSA (OR=17, 95% CI 1-283, p=0.048) on univariable analysis, whereas there was no association with deep venous drainage. However, this association did not persist on multivariable analysis.

Conclusion: Intraoperative DSA is a critical adjunct for AVM surgery, as residual lesions can be subtle. Given that even lesions that appear obliterated pose a risk of later recurrence, our protocol is to perform a delayed angiogram in the biplane fluoroscopy suite. AVMs that were characterized as diffuse were both more likely to have residual identified on intraoperative angiogram requiring further resection, and to later recur despite a clean angiogram at the conclusion of resection. This information may encourage the utilization of intra operative and frequent postoperative angiograms for diffuse AVM patients.

Microsurgical resection of eloquent brain AVMs

Gary K Steinberg, MD, PhD
Department of Neurosurgery, Stanford University School of Medicine

Michael Stuart, MBBS
Department of Neurosurgery, Stanford University School of Medicine

Introduction: Intracranial arteriovenous malformations are some of the most difficult neurosurgical lesions to treat and surgical resection of AVMs in eloquent brain areas is especially formidable. Eloquent regions include critical motor, sensory, language, visual, thalamic, basal ganglia, deep cerebellar nuclei, corpus callosum and hypothalamic regions.

Methods: Using a prospectively maintained database of vascular malformation patients treated at Stanford University Medical Center from 1987-2025, retrospective analysis of all intracranial AVM patients undergoing microsurgery were identified. Preclinical demographics, presentation, clinical grading, surgical adjuncts and postoperative clinical outcomes were collected.

Results: Of more than 1600 intracranial AVMs treated by the senior author at Stanford Medical Center from 1987-2025, microsurgical resection was performed in 905 patients including 45% in eloquent regions. Two thirds of these AVMs were ruptured. Endovascular embolization and preoperative stereotactic radiosurgery were used in some patients prior to surgery. For patients with eloquent unruptured AVMs major neurologic deficits at discharge were 39%; at 6 mos postop were 18%, and at 2 yrs postop were 15%. Two year outcomes for these patients were mRS 0-1: 63%, mRS 2: 15%, mRS 3: 9%, mRS 4: 2%, mRS 5: 0; mRS 6: 5%. For unruptured eloquent AVM patients with pre-surgical mRS 0-1, 2-year outcomes were: 80% mRS 0-1. Postoperative motor deficits disproportionately reduced mRS at followup compared to other deficits. Preoperative embolization significantly correlated with worse neurological outcome. Important adjunctive techniques included DTI tractography, functional mapping (preoperative and intraoperative), intraoperative navigation, intraoperative neurophysiologic monitoring and staged surgical resection.

Conclusions: Surgical treatment of eloquent location brain AVMs continues to be challenging. However, despite a high incidence of immediate postoperative neurologic deficits, they can be cured with low risks of new long-term deficits using microsurgical resection, often as part of multimodality therapy. Adjunctive preoperative and intraoperative techniques improve the surgical outcomes.

2025 Clinical Science Resident Award Recipient

Shivani Baisiwala
UCLA

Shivani Baisiwala is currently a PGY-5 neurosurgery resident at UCLA. She earned her BS and MS from Stanford University and her MD from Northwestern University.

During her dedicated research year, she worked in Dr. Aparna Bhaduri's lab developing organoid models of glioblastoma, utilizing techniques such as lineage tracing, Perturb-seq screens, and immune–tumor co-cultures. She was funded by a T32 Cell Biology Fellowship.

She is interested in pursuing a career in academic neurosurgical oncology.

Developing an Autologous Human Tumor-Immune Organoid Model for Glioblastoma

Shivani Baisiwala, MD
University of California, Los Angeles

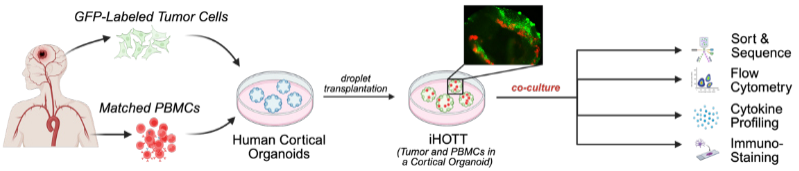
Shivani Baisiwala MD, Elisa Fazzari, Matthew X Li, Antoni Martija PhD, Daria J Azizad, Lu Su PhD, Gilbert Herrera, Isabelle Phan, Amber Monteleone, David A Nathanson PhD, Anthony Wang MD, Won Kim MD, Richard G Everson MD, Kunal S Patel MD, Linda M Liau MD MBA, Robert M Prins PhD, Aparna Bhaduri PhD

Introduction: Glioblastoma is a highly aggressive brain tumor with a dismal prognosis, in part due to its ability to evade immune detection through an immunosuppressive microenvironment. While immune checkpoint inhibitors have shown promise in other cancers, glioblastoma remains largely resistant to immunotherapy. There is a critical need for physiologically relevant, patient-derived human models to investigate mechanisms of immune resistance and response.

Methods: We developed and validated iHOTT, a human tumor–immune organoid transplantation system, in which patient glioblastoma cells and matched circulating immune cells (PBMCs) are co-cultured within mature human cortical organoids. This model was evaluated using single-cell RNA sequencing, cytokine profiling, immunofluorescence, and T cell receptor (TCR) sequencing. Results from iHOTT were benchmarked against pembrolizumab-treated and untreated patient tumor samples.

Results: iHOTT preserved diverse tumor and immune compartments, supported cytokine production in the presence of both tumor and immune cells, and demonstrated robust immune activation at both the transcriptional and protein levels. Upon pembrolizumab treatment, the model mirrored multiple aspects of patient immune responses, including expansion of T cells, B cells, and ILCs. Cell–cell interaction analyses showed increased signaling involving unconventional T cell subsets such as MAIT and γδ T cells, which were mirrored between patient samples and iHOTT. Furthermore, we noted upregulation of immunologically relevant pathways, including complement, CD226, and CD70, in both iHOTT and patient datasets. TCR sequencing revealed increased clonal diversity driven by CD4 T cells in treated iHOTT samples, consistent with patient tumor profiles. Clonotype clustering revealed largely private, patient-specific responses in both datasets, reflecting the inter-tumoral heterogeneity that may underlie inconsistent responses to PD-1 blockade in glioblastoma.

Conclusions: This autologous organoid platform provides a scalable, multimodal system to model patient-specific tumor–immune dynamics, dissect immunotherapy mechanisms, and support biomarker discovery and therapeutic development in glioblastoma.



2025 Basic Science Resident Award Recipient

Anthony Lee
UCSF

Born and raised in Arlington, Texas, Dr. Anthony Lee attended Duke University on a full academic scholarship before earning his MD/PhD at UCSF.

Working with Vikaas Sohal under an F30 fellowship, he used patch-clamp electrophysiology, optogenetics, and calcium imaging to investigate how rodent prefrontal circuits process information. He later collaborated with Tomasz Nowakowski and Edward Chang under an R25 award, applying RNA sequencing to study the functional cytoarchitecture of the human brain.

Now a Chief Resident in Neurosurgery at UCSF, Dr. Lee's clinical interests include functional neurosurgery and spine, and he plans to remain in academia to integrate his research and clinical work. Outside of medicine, he enjoys spending time with his wife and son, being outdoors, biking, and running.

Region-specific functional cytoarchitecture in human superior temporal gyrus underlie divergence in language processing and autism

Anthony Lee, MD PhD
University of California San Francisco

Chang Kim BS, Alma Dubuc MA, Albert Wang BS, Rachel Leonard BS, Thomas Renne, Edward Chang MD, Tom Nowakowski PhD

Introduction: Understanding how cellular architecture supports specialized brain functions is a central challenge in neuroscience. While single-cell atlases reveal diverse brain cell types, they often lack direct links to circuit-level function and clinical relevance. The human superior temporal gyrus (STG), essential for auditory and language processing, has functionally distinct subregions: posterior STG (pSTG), which shows onset responses to speech, and anterior STG (aSTG), which shows sustained responses. We hypothesize that these differences arise from molecular and cellular specializations unique to humans. To test this, we integrate spatial transcriptomics, single-nucleus RNA sequencing, and functional assays across humans, macaques, and mice, linking findings to autism spectrum disorder (ASD) outcomes.

Methods: We performed snRNA-seq and spatial transcriptomics on human STG tissue resected after intraoperative auditory mapping with micro-electrocorticography (uECOG). We compared gene expression and cell types between anterior and posterior STG in human and macaque brains. Functional relevance was tested via optogenetic overexpression studies in mice. ASD clinical relevance was assessed using SPARKv2 data.

Results: Transcriptomic profiling of over 310,000 cells identified 20 STG cell types. Distinct cell ensembles and interactions emerged between aSTG and pSTG, especially in upper-layer posterior regions. Interneurons in human pSTG showed enriched differentially expressed genes (DEGs) compared to aSTG, a pattern diminished in macaques. Functional overexpression of the top pSTG DEG in mice increased interneuron excitability, validating its role in cortical function. SPARKv2 data revealed that mutations in this gene were associated with language deficits in ASD, suggesting clinical relevance.

Conclusions: We identify region-specific cellular specializations in the human STG tied to language function and neurodevelopmental risk. This work links molecular and functional divergence in human cortical circuits to disease, advancing our understanding of how single genes shape human-specific brain specialization.

Saturday, September 13, 2025
Scientific Session III

Resident Rapid Fire

Glycolysis-Cholesterol Metabolism Crosstalk in Glioblastoma: Disruption of Lipid-Rich Membrane Domains as a Metabolic Vulnerability of Pro-tumoral Myeloid Cells

Lily H. Kim, MD
Stanford University

John Choi, MD, MEd; Ryan Nitta, PhD; Andrew Tran, BS; Brandon Bergsneider, BS; Ethan Schonfeld, MS; Si Yeon Lee, BS; Ayush Pant, BS; Xinnan Wang, MD, PhD; Gordon Li, MD; Christina Jackson, MD; Michael Lim, MD

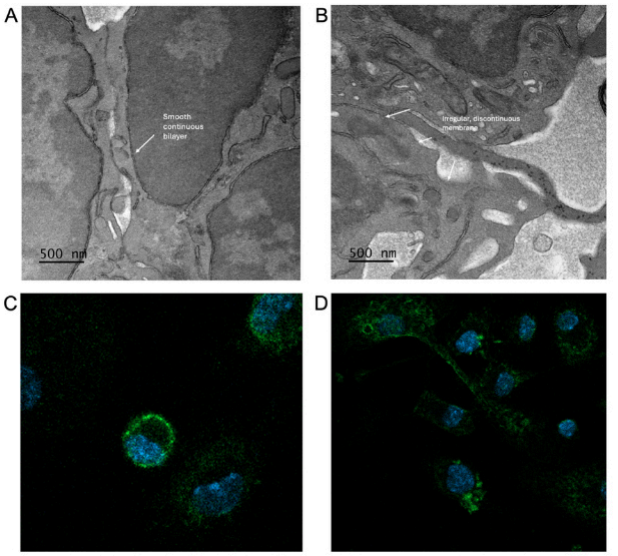
Introduction: Glioblastoma (GBM) tumor microenvironment (TME) is hypoxic and nutrient-scarce, conditions typically unfavorable for cellular survival. GBM uniquely harbors a predominant population of pro-tumoral myeloid cells, such as myeloid-derived suppressor cells (MDSCs), contributing to its immunosuppressive milieu. We hypothesized that these myeloid cells must employ unique metabolic adaptations to thrive in this hostile environment. Here, we uncover a novel interplay between glycolysis and cholesterol homeostasis, revealing a metabolic vulnerability in these myeloid cells, mediated by lipid-rich membrane domains (lipid rafts) essential for their glycolytic activity.

Methods: MDSCs were differentiated from hematopoietic stem cells of C57BL/6J mice. Metabolic profiling was conducted using Seahorse XF to measure extracellular acidification rate (ECAR) as an indicator of glycolysis. Transcriptomic data was derived from single-cell RNA sequencing (scRNA-seq) performed on 22 human GBM samples. Flow cytometry facilitated immunophenotyping and quantification of glucose transporter (GLUT3) expression. ELISA was used to detect cytokine production. Transmission electron microscopy (TEM) was performed to visualize cellular structures. Lipid rafts was stained and examined via immunofluorescence microscopy.

Results: MDSCs exhibited robust glycolytic activity with higher ECAR than T cells under both normoxic ($P=0.0002$) and hypoxic conditions ($P<0.0001$). Human GBM scRNA-seq data revealed elevated expression of cholesterol regulator ABCA1 in immunosuppressive myeloid populations, strongly correlating with the hypoxia-inducible factor HIF1α and GLUT3 expression. Pharmacological inhibition of ABCA1 with Valspodar markedly diminished glycolytic activity ($P=0.0012$), GLUT3 expression ($P=0.0002$), and immunosuppressive cytokine production (TGF-β1) ($P=0.0075$). TEM imaging showed disrupted cellular membranes in ABCA1-inhibited cells, while fluorescent microscopy demonstrated impaired lipid raft integrity.

Conclusions: This study identifies a critical glycolysis-cholesterol metabolic crosstalk in GBM that sustains lipid raft integrity and glycolytic efficiency in pro-tumoral myeloid cells. Disruption of ABCA1-dependent cholesterol efflux compromises glucose transporter localization, leading to reduced glycolysis, cellular proliferation, and immunosuppressive activity, suggesting a potential metabolic vulnerability that can be therapeutically exploited to reverse immunosuppression in GBM.

Figure. ABCA1 inhibition disrupts cellular membrane integrity and lipid raft organization in myeloid-derived suppressor cells (MDSCs). Representative transmission electron microscopy (TEM, top panels, A/C) and fluorescent microscopy (bottom panels, B/D) images comparing untreated (control) MDSCs and MDSCs treated with an ABCA1 inhibitor. TEM images demonstrate smooth, continuous plasma membranes in control MDSCs, while ABCA inhibitor-treated cells exhibit irregular and discontinuous membrane structures (indicated by arrows). Fluorescent microscopy highlights lipid raft domains (green), revealing robust lipid raft integrity in control cells versus disrupted lipid raft distribution upon ABCA1 inhibition. Nuclei were stained with DAPI (blue). Scale bars represent 500 nm (TEM) and 63x oil magnification was used for fluorescence microscopy images.



Sun Valley, Idaho was the first ski resort in the world to use chairlifts. In 1936 the fee was .25 cents per ride. In 2025 the fee is $242. per day lift ticket.

Enhanced Measures to Quantify Gait and Balance Impairment in Degenerative Cervical Myelopathy: A Prospective Cohort Study

Khadija Soufi, MD
University of California, Davis

Giselle Ghabussi; Tiffany Chu; Omar Ortuno, MD; Nádia F. Simões de Souza, MD; Alan Harris, MS; Jose A. Castillo, MD; Kee D. Kim, MD; Allan R. Martin, MD, PhD

Introduction: Degenerative cervical myelopathy (DCM) is the leading cause of non-traumatic spinal cord dysfunction in adults, resulting in progressive gait instability, impaired balance, and increased fall risk. Standard grading systems (e.g., mJOA) and coarse manual tests often miss subtle or early deficits, delaying diagnosis and treatment. Pressure-mat walkways yield rich spatiotemporal data but require specialized equipment and analysis time unsuitable for routine clinics. We sought to develop a rapid, bedside screening battery combining targeted manual balance tests with key electronic-walkway metrics to (1) accurately detect overt and subclinical gait and balance impairments in DCM, (2) discriminate DCM from healthy volunteers, and (3) correlate with disease severity.

Methods: In this prospective case-control study, 137 adults with MRI-confirmed DCM (mean age 57 ± 11 y; 65 % male) and 101 age- and sex-matched healthy volunteers (mean age 55 ± 10 y; 60 % male) underwent the modified Japanese Orthopaedic Association scale (mJOA), Neck Disability Index (NDI), and an abbreviated nine-item Berg Balance test. Manual clinical assessments included tandem gait (number of missteps), single-leg stance (eyes open, seconds), tandem stance (pass/fail), and Romberg (eyes closed, seconds). On an electronic pressure-mat walkway (ProtoKinetics), participants performed self-paced and fast-paced walks to derive mean velocity (m/s), gait stability ratio (GSR), and gait variability index (GVI). Group differences were assessed using independent t-tests and chi-squared tests. Pearson correlations compared each measure to the mJOA lower extremity subscore. Receiver operating characteristic (ROC) analysis determined sensitivity, specificity, optimal cutoffs, and Youden index. A predefined subgroup (DCM-SNB) of patients reporting “no balance problems” (n = 42) was analyzed separately.

Results: All manual and walkway metrics significantly differed between DCM and controls ($p < 0.03$). Tandem gait missteps correlated moderately with mJOA-LE ($r = 0.48$; $p < 0.001$) and achieved 76 % sensitivity/59 % specificity at ≥ 2 missteps. Pressure-mat measures in DCM versus controls were velocity 0.95 ± 0.21 vs. 1.34 ± 0.18 m/s; GSR 1.42 ± 0.27 vs. 0.98 ± 0.19; GVI 0.58 ± 0.13 vs. 1.00 ± 0.11 (all $p < 0.001$). Velocity demonstrated the strongest mJOA-LE correlation ($r = 0.64$; $p < 0.001$). In DCM-SNB patients, manual tandem gait and GVI remained abnormal ($p < 0.01$), revealing subclinical impairment.

Conclusions: A three-minute screening battery tandem gait, single-leg stance, and timed walking effectively detects both manifest and covert gait/balance deficits in DCM without specialized equipment. Pressure mat parameters offer a quantitative research standard and promising endpoints for future interventional trials.

Early Follow-Up Results in Patients Undergoing Uniportal Full Endoscopic Cervical Unilateral Laminectomy and Bilateral Decompression

Steve S. Cho, MD
Barrow Neurological Institute

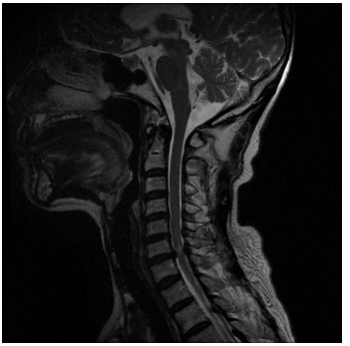
Yoon-ha Hwang, MD. Harrison Spinartus Hospital, Seoul, South Korea
Hyeun-sung Harrison Kim, MD, PhD. Harrison Spinartus Hospital, Seoul, South Korea

Introduction: Cervical spondylosis afflicts 5-20% of the population and is commonly treated using posterior decompression. Early results of laminectomy alone without fusion demonstrated significant risks of postoperative kyphosis and thus, laminectomy with posterior fixation or laminoplasty remains the gold standard for posterior decompressions of the cervical cord.
This study investigates whether posterior laminectomy performed via the uniportal full endoscopic approach can effectively decompress the cervical cord while preventing postoperative kyphosis.

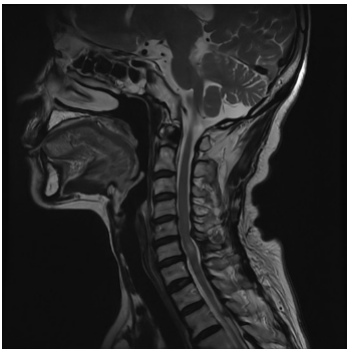
Methods: This was a single-institution, single-surgeon retrospective case series. Patients who met inclusion criteria for posterior decompression between August 2023 and August 2024 underwent uniportal full endoscopic cervical unilateral laminectomy and bilateral decompression (UNI-CE-ULBD). Preoperatively and 1, 3, and 6 months postoperatively, plain-film radiograph, CT, and MRI of the cervical spine were obtained to assess the extent of decompression and to measure cervical sagittal alignment parameters and range of motion (ROM).

Results: UNI-CE-ULBD was performed in 24 patients during the 1-year study period, with 12 patients having >6-month follow-up visits (range 6.0-13.3months). On 6-month MRI, the mean canal stenosis had improved in all patients, with mean improvement from 40.0±11.1% to 6.6±15.3% ($p<0.0001$). At 6 months, no significant change in overall alignment, segmental alignment, or ROM was seen and no instability had occurred. Four individuals demonstrated mild decreases in cervical lordosis at 6 months. Clinically, patients demonstrated improvements in neck/arm pain and myelopathy, and 3 of 5 patients with preoperative motor deficits demonstrated significant recovery in motor function, with no new or worsening motor deficits. Modified Japanese Orthopedic Association scores improved from 14.2±1.9 preoperatively to 15.8±1.1 6 months postoperatively ($p=0.0001$). There were no intraoperative or perioperative complications or reoperations.

Conclusions: UNI-CE-ULBD achieves excellent decompression of the cervical cord without leading to short-term postoperative malalignment. UNI-CE-ULBD may potentially reduce the need for cervical arthrodesis or laminoplasty and warrants further investigation.



Preoperative MRI Sagittal showing C6-7 stenosis



Postoperative MRI showing decompression

Coeur d'Alene Resort is home to the world's only floating golf green. The artificial island green weighs five million pounds and moves daily via underwater cable to adjust the yardage

Sunday, September 14, 2025
Scientific Session IV

Spine Surgery

The First Grade III Lumbar Spondylolisthesis treated with The Novel 360-Degree Artificial Disc/Artificial Facet Replacement (ADR/TOPS) Solution

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Neurosurgery & Spine Group
Institute for Neuro Innovation Cedars Sinai Medical Center

Jack Pietros, BS, Cooper Gardner, BS, Amir Vokshoor, MD, FAANS

Background: The Incidence of spondylolisthesis increases with age and is more prevalent in females. "High-grade" (above Grade II) occurs in 10-12% of affected individuals. If conservative therapy fails, the standard of care for decades has been fusion. However, fusion presents concerns regarding biomechanical load transfer to adjacent vertebrae. In this report, we describe an innovative 360-degree, motion-preserving surgical approach utilizing two FDA approved devices, the ProdiscL Artificial Disc Replacement (ADR) and the Total Posterior Spine (TOPS) System, in an 'off-label' investigation for the treatment of high-grade spondylolisthesis and associated disc space collapse.

Methods: Case report as part of a multi-institution, IRB approved, prospective cohort trial. Subjective and objective outcomes were collected every 6-12 weeks. Outcome measures included: neurologic exam, VAS Back Pain, VAS Leg Pain, PROMIS Physical and Mental Health, SF-12, repeat surgery, and post-op dynamic x-rays. A 36-year-old male presented to clinic with complaints of progressive 7-8/10 low back pain with pain radiating down legs bilaterally. Patient reports years of symptoms, only mildly managed with conservative therapy. He had been offered fusion by multiple surgeons. Imaging demonstrated progression of his known L5-S1 grade II spondylolisthesis with severe disc space collapse to now grade III.

Results: The ODI improved from 16 to 2 (87.5%) at 3-months post-op. VAS score for back, left, and right leg pain were 4.87, 2.41, and 1.51 pre-operatively. All VAS scores decreased to 0 by 3-months. The PROMIS Physical Health score of 14 remained relatively stable at 13 at 3-months. The SF-12 Physical and Mental Component Scores improved by 16.7% and 21.23%, respectively. By six weeks the patient expressed high satisfaction 8/10, improving to 10/10 by 3-months. Results have been maintained at 6-months.

Conclusions: This case illustrates encouraging early data in support of a 360-degree arthroplasty concept in the treatment of high-grade spondylolisthesis.

Does Velocity of Return-to-Work Differ between Circumferential Minimally-Invasive and Open Surgery to Treat Adult Spinal Deformity?

Nathan Han, MD
University of California, San Francisco

Nima Alan, MD, Mohamed Macki, MD, MPH, Michael Tawil, MPH, Nathan Han, MD, Marc Prablek, MD, Vivian P. Le, MPH, Alexander Aabedi, MD, Paul Park MD, Juan S. Uribe, MD, Jay D. Turner MD, PhD., Robert K. Eastlack, MD, Richard G. Fessler, MD, PhD, Kai-Ming Fu, MD, PhD, Michael Y. Wang, MD, Adam S. Kanter, MD, David O. Okonkwo, MD, PhD, Pierce D. Nunley, MD, Neel Anand, MD, Gregory M. Mundis, Jr., MD, Peter G. Passias, MD, Shay Bess MD, Christopher I. Shaffrey, MD, Dean Chou, MD, Praveen V. Mummaneni, MD, MBA, International Spine Study Group

Introduction: Adult spinal deformity (ASD) impacts functional ability and quality of life, often influencing patients' ability to work. Surgical correction can improve alignment and symptoms; however, recovery timelines may vary depending on surgical technique. We sought to compare circumferential minimally-invasive surgery (cMIS) to open deformity correction surgery on patients' timing of return to work.

Methods: Prospectively collected data from the International Spine Study Group (ISSG) multicenter database was queried for ASD correction. Patients were evaluated in two cohorts: cMIS or open surgery. Propensity scoring matched age, body mass index, pelvic incidence–lumbar lordosis mismatch, and sagittal vertical axis. All patients had at least 2 year follow-up. The cohorts were compared at 6 weeks, 1 year, and 2 years.

Results: Of 173 matched patients (85 open, 88 cMIS), there were no significant differences in age, gender, or ASA classification. Average age was 68.2 years with ≥3 levels fused. The open group had significantly more direct posterior decompressions, higher median number of transforaminal lumbar interbody fusions, longer surgery time, greater blood loss, and longer hospital stay. The cMIS group had a higher median number of lateral lumbar interbody fusions. Baseline employment status did not differ significantly: disabled (4.7% vs 6.8%), employed (20.0% vs 21.5%), retired (71.7% vs 67.0%), unemployed (3.5% vs 4.5%). At 6 weeks, employed patients were similar (14.1% vs 15.9%, p=0.741); at 1 year, significantly more cMIS patients returned to work (10.5% vs 21.5%, p=0.049). At 2 years, more cMIS patients had returned to work (14.1% vs 19.3%), but this was not significant (p=0.277).

Conclusion: Patients undergoing cMIS surgery returned to work at a higher rate between 6 weeks and 1 year postoperatively. At 2 years, return-to-work remained higher for cMIS but was no longer significant.

Radiographic Cervical Spine Volumetric Tissue Loss and Delayed Neurological Decline After Spinal Cord Injury

Ali Ravanpay, MD, PhD
University of Washington, Seattle

Malia McAvoy, MD, MS[1], Nadia Marnani, BS[2], Evgeniya Tyrtova, MD[1], Stephen Burns, MD[3, 6], Kendl Sankary, MD[4], Lei Wu, MD[4], Ali Ravanpay, MD, PhD[1,5]

[1]Department of Neurological Surgery, University of Washington, Seattle, WA, [2]University of Washington School of Medicine, Seattle, WA, [3]Spinal Cord Injury Service, Veterans Affairs Puget Sound Health Care System, Seattle, WA, [4]Department of Radiology, Veterans Affairs Puget Sound Health Care System, Seattle, WA, [5] Neurosurgery, Veterans Affairs Puget Sound Health Care System, Seattle, WA, [6] Department of Rehabilitation Medicine, University of Washington, Seattle, WA

Introduction: The objective of this study was to quantify long term neurodegenerative changes along the cervical spinal cord rostral to a spinal cord injury (SCI) by means of volumetric analysis and determine the relationship with delayed neurologic deterioration.

Methods: Semi-automatic volumetric analysis of retrospectively collected cervical spine magnetic resonance imaging (MRI) was performed among consecutive veterans who had cervical SCI with delayed clinical decline and follow up spine MRIs between 2012 and 2019. These data were compared with the volumetric analysis of veterans with cervical SCI who had no clinical change.

Results: There were 24 veterans with progressive neurologic decline and 10 veterans without decline. Among patients with progressive neurologic decline, there was an average of 6.7% volume loss of the cervical spine per year (standard deviation 8.7%) over an average of 7.64 years. Those without neurologic decline also had volume loss of 35.0% per year (standard deviation 15.0%) over an average period of 0.93 years. There was no significant difference in the change in volumes between the group of patients with neurologic decline and those without.

Conclusions: Neurodegeneration of the cervical spinal cord may be evident remote from the time of SCI. This finding does not necessarily correlate with clinical decline.

Safety outcomes following circumferential cervical fusion with an investigational PCF device compared to ACDF alone: results from 227 prospectively enrolled subjects with 3-level disease

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Pierce Nunley, MD, Spine Institute of Louisiana; Gabriel Tender, MD, Louisiana State University; Joshua Heller, MD, Thomas Jefferson University; Alexander Lemons, MD, Pinehurst Surgical Clinic; Daniel Williams, MD, Pinehurst Surgical Clinic; Rahul Shah, MD, Premier Orthopaedic Associates; K. Brandon Strenge, MD, Strenge Spine Center; Marcus Stone, PhD, Spine Institute of Louisiana; Jeffrey Beecher, DO, Atlantic Brain and Spine

Introduction: In patients with multi-level disease, a surgeon may opt to include supplemental posterior fixation to an anterior fusion to improve the rate of arthrodesis, however this adjunct potentially introduces risk for complications and readmission. This analysis summarizes how the added surgical burden of supplemental posterior fusion with an investigational posterior cervical stabilization system (CCF) impacted post-operative complication rates compared to an anterior-only approach (ACDF) when treating 3 levels.

Methods: Subjects had myeloradicular symptoms from degenerated discs at 3 cervical levels and were randomized 1:1 to ACDF or CCF. Adverse events were recorded according to onset time, relationship, and severity as adjudicated by an independent clinical events committee.

Results: The final 12-month safety dataset consisted of 227 subjects (115 ACDF, 112 CCF, 58±10 years, 57% female). Subjects in the CCF arm had an additional median 48 minutes of procedure time and median 10ccs of estimated blood loss due to the supplemental PCF procedure. Median length of stay was one night and was similar between the two cohorts ($p=0.293$). Through the first three months following treatment, 12 ACDF subjects (10.4%) and 6 CCF subjects (5.4%) required extended or re-hospitalization due to treatment related complications. Through the first 12 months following treatment, the CCF arm had a lower number of related events when compared to the ACDF arm (CCF=57.1%, ACDF=74.8%, $p<0.001$). There was one CCF subject requiring surgical revision (1.7%, malpositioned cage) compared to 21 in the ACDF arm (18.3%, 19x pseudarthrosis, 1x ASD, 1x correct kyphosis).

Conclusions: When performed with a tissue-sparing approach, the added surgical burden from PCF did not increase the risk of extended or re-hospitalization, had a lower incidence of any treatment related complications, and significantly reduced the risk of subsequent surgical intervention in the 12 months following treatment when compared to treatment with ACDF alone.

24 Years Experience of Artificial Disc Replacement (ADR) and Where We Are (hopefully…) and should be going!

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Cedars Sinai Spine Center, Los Angeles, CA

Eli Baron MD, Terrence Kim MD, Cedars Sinai Spine Center, Los Angeles
Samer Ghostine MD, UCLA Department of Neurosurgery, Los Angeles, CA

Introduction: Artificial disc surgery in both the cervical and lumbar spine has gained recent interest yet true advances have proceeded slowly over three decades that began in 2001 with initial trials in the US.
The 2000's saw the initial clinical trials in both cervical and lumbar artificial discs, that we participated, to determine device safety supervised by the FDA. These single level efficacy studies were conducted in conjunction with device manufacturers and leading US medical centers.
The next decade beginning approximately 2010 saw slow progress with the expansion of utilizing both cervical and lumbar ADRs to include two levels of adjacent degenerative discs in similar clinical and FDA/multicenter studies. There are only six cervical ADRs in use and only one lumbar device on the market in the US currently.
The current decade has seen no advancements in the use and applications of existing ADRs beyond the two-level studies other than some growing experience from a handful of surgeons utilizing off-label applications across the US, and there does not appear to be new technology or expanded use of the existing devices on the horizon. Restrictions of use by the major health insurance carriers who have adopted their own interpretations of the inclusion/exclusion criteria function to deny patients care with these "FDA Approved" devices. Some carriers still consider ADRs as "experimental" despite very strong clinical data and some with over 10 years of outcome data.

Conclusions: The growing knowledge of "off-label" uses of cervical and lumbar ADRs that are published and reported supports the expansion of applications for 3-4 level ADRs, adjacent segment disease and levels not studied are the focus of this presentation and discussion along with our 24 years of experience is presented.

Robot-Assisted Cervical Pedicle Screw Placement: Case Series and Technical Description

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[1]Rocky Vista University College of Osteopathic Medicine, Parker, CO
[2]Department of Neurosurgery, University of California San Diego School of Medicine, La Jolla, CA, [3]Alfaisal University College of Medicine, Riyadh, Saudi Arabia

Introduction: Robot-assisted (RA) techniques with pedicle implant placement have demonstrated improved accuracy and safety in thoracolumbar spinal surgery, but their application in the cervical spine has been less described due to the smaller anatomic corridors with high risk of neurovascular injury. Although multiple spinal robotic systems are currently approved by the Food and Drug Administration for spinal fusion procedures, much of the illustration and discussion has been around thoracolumbar instrumentation. As a result, cervical procedures remain underdiscussed regarding specific workflow adaptations and instrumentation techniques. We aimed to present a case series followed by a reproducible stepwise workflow for robot-assisted cervical pedicle screw placement in spine surgery.

Methods: This is a retrospective single center series of consecutive patients who underwent robot-assisted cervical pedicle screw placement by a single surgeon. Perioperative complications, radiographic results, and clinical outcomes were collected.

Results: A total of 8 patients with 50 cervical pedicle screws placed were identified. Demographic analysis showed a mean age of 63.1 (range 49-75) with 50% female (4 patients). Diagnosis was degenerative (2 patients), tumor (2 patients), trauma (2 patients), and deformity (2 patients). The 50 pedicle screws were distributed at C1 (8 screws), C2 (8 screws), C3 (6 screws), C4 (6 screws), C5 (6 screws), C6 (8 screws), and C7 (8 screws). There was one inferior Gertzbein—Robbins grade B breach at a C7 screw without clinical sequelae that was repositioned for a total screw accuracy of 98%.

Conclusions: RA cervical pedicle screw placement appears to be a safe and effective adjunct in complex cervical spine surgery. The proposed stepwise workflow is reproducible and adaptable. Further studies are warranted to validate these findings in larger cohorts and to assess long-term outcomes. Additionally, further development of tailored cervical spinal instrumentation for robotic systems will facilitate a fully robot-assisted technique.

Sunday, September 14, 2025
Scientific Session V

Functional

Thalamotomy for Facial and Non-Facial Neuropathic Pain

Shervin Rahimpour MD, FAANS, FCNS
University of Utah, Salt Lake City, UT

Cody J. Orton, BA[1], Matthew C. Findlay, MD[1], Niels Pacheco[3], Ahmed Al Dulaimi[2], Jayson R. Nelson, BS[1], Aaron E.L. Warren, PhD[3], Shervin Rahimpour, MD[4]

1. Spencer Fox Eccles School of Medicine, University of Utah, Salt Lake City UT, 2. Department of Psychology, University of Utah, Salt Lake City, UT, 3. Department of Neurosurgery, Brigham and Women's Hospital, Harvard Medical School, Harvard University, Boston, MA, 4. Department of Neurosurgery, Clinical Neurosciences Center, University of Utah, Salt Lake City, UT

Introduction: Refractory neuropathic pain is a chronic, debilitating condition for which thalamotomy can be a treatment. Although multiple ablation targets exist, the optimal thalamic target for therapeutic response across both facial (FP) and non-facial (NFP) neuropathic pain remains unknown. We sought to assess outcomes and identify a thalamic 'sweet spot'.

Methods: We performed a systematic review and meta-analysis identifying studies of patients who underwent thalamotomy for FP and NFP from PubMed and Embase from 2012 through 2023. Study inclusion criteria were patient age ≥18 years, sample size ≥5, and follow-up period ≥3 months. The primary outcome measure was % reduction in reported pain. When possible, anatomical locations were determined by registering stereotactic coordinates of ablation sites to a common brain template and thalamic atlas. Relationships between contralateral and bilateral targeting, thalamic nucleus target, and patient-reported outcomes were assessed.

Results: Our search yielded seven studies for review and six studies for analysis with a total of 86 patients. Ablation side (bilateral versus contralateral) did not significantly influence outcomes, ($p>0.05$). Adjusted Tobit linear regression modeling found patients with FP experienced significantly greater pain reduction post-treatment (32.54% improvement, 95% confidence interval [CI] 13.76%-51.32%, $p<0.01$) vs NFP. Similar modeling showed that focused ultrasound (FUS) was associated with significant improvements in post-treatment pain reduction compared to gamma knife radiation surgery, regardless of pain type (22.04% improvement, CI 2.13%-41.95%, $p=0.03$). Efficacy was highest for ablations targeting the parafascicular nucleus, which had a median reported pain reduction of 85%. The central lateral, medial pulvinar, and anterior pulvinar nuclei showed less favorable outcomes, with median patient pain reductions of 50%, 74%, and 2%, respectively.

Conclusions: Thalamic ablation is an effective treatment for both FP and NFP. Patients with FP may experience greater pain reduction, and FUS may yield improved outcomes. The parafascicular nucleus is a promising target.

Towards personalized, precision neuromodulation in drug-resistant epilepsy: single-center experience in thalamic stereoEEG

Andrew I. Yang, MD, MS
Barrow Neurological Institute

Kris A. Smith, MD[1]; Stephen T. Foldes, PhD[2]; David P. Harris, MD[2]
Department of Neurosurgery[1], Neurology[2], Barrow Neurological Institute

Introduction: Since the pivotal trials of anterior nucleus of thalamus (ANT) DBS and Responsive NeuroStimulation (RNS), there has been widespread adoption of invasive neuromodulation for drug-resistant epilepsy (DRE). Concomitantly, there has been increased variability across institutions in how neuromodulation is implemented in individual patients, particularly in patients with difficult-to-treat features, who were either excluded or under-represented in the pivotal trials, e.g., generalized, multifocal (>2 seizures onset zones [SOZ]), posterior quadrant, diffuse/ regional epilepsy. However, there is a scarcity of data and clinical experience to inform personalized neuromodulation in DRE. Inclusion of putative neuromodulation targets during Phase 2 invasive monitoring has been utilized at our institution towards this end.

Methods: Single-institution retrospective review of consecutive patients who underwent stereoEEG (SEEG) at a Level 4 Comprehensive Epilepsy Center. The degree to which distinct thalamic nuclei were involved in the individual patient's seizure network was assessed with visual analysis of ictal SEEG, as well as subcortico-cortical evoked potentials.

Results: Of the 64 patients who underwent SEEG during the study period (12/2023-5/2025), thalamic nuclei were included for implant in 60 patients. Thalamic nuclei studied included: ANT in 59 patients (98%), pulvinar in 41 (68%), centromedian (CM) nucleus in 7 (12%), and mediodorsal (MD) nucleus in 3 (5%). Bilateral thalamic SEEG was performed in 19 patients (32%), in all of whom there were bilateral pre-implant hypotheses. There were no surgical complications directly related to the inclusion of thalamic structures during SEEG. Thalamic SEEG directly informed subsequent surgical intervention in 16 patients (27%). For ANT, 4 patients underwent ANT DBS, 2 underwent multi-target thalamic DBS, and 2 underwent corticothalamic RNS with electrodes in ANT and the SOZ. For pulvinar, 1 patient underwent pulvinar DBS, 1 underwent multi-target thalamic DBS, and 6 patients underwent corticothalamic RNS of pulvinar + SOZ. For CM, 1 patient underwent CM DBS, and another underwent multi-target thalamic DBS. The 2 patients treated with multi-target thalamic DBS were implanted in ANT + CM and ANT + pulvinar.

Conclusions: Inclusion of thalamic structures during SEEG is safe, and yields clinically-relevant data. Thalamic SEEG directly informed subsequent surgical management in 14% of patients in whom ANT was studied, 20% of patients for pulvinar, and 29% for CM. Ongoing research is focused on developing a data-driven framework to inform personalized, precision neuromodulation.

Intraoperative Electrocorticography Guided Resection in Patients with Seizures Associated with Cerebral Cavernous Malformations

David Caldwell[1], MD, PhD Resident Speaker
University of California San Francisco, Department of Neurological Surgery

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2. Warren Alpert School of Medicine, Brown University
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4. Paul L. Foster School of Medicine, Texas Tech Health Science Center
5. Loyola University School of Medicine

Introduction: Cerebral cavernous malformations (CCMs) can bleed and result in seizures, and surgical resection is frequently employed for treatment. Intraoperative electrocorticography (IoECoG) is valuable in epilepsy surgery and tumor resection. The decision to use IoECoG in CCM lesionectomy remains undefined. This study investigates IoECoG utilization in CCM resection

Methods: This was a retrospective cohort of patients admitted to the University of California, San Francisco with seizures and CCMs who underwent resection with or without IoECoG (2006-2024). Logistic regression was used to identify independent predictors of IoECOG utilization. Mann-Whitney U and Fisher's exact tests were used to compare surgery duration and complication profiles. Ordinal mixed effects models were used to test the impact of IoECOG on changes in functional status as assessed through the modified rankin scale (mRS), seizure frequency, and antiepileptic drug (AED) utilization.

Results: Of 86 patients, 31 underwent IoECoG-guided resection. Longer time from seizure onset to surgery was associated with IoECoG use ($p<0.05$). Patients presenting with solitary seizures ($p<0.05$) and subacute hemorrhages ($p<0.05$) were associated with standard resection. Surgery duration was longer ($p<0.01$) in IoECoG-guided lesionectomy (193.7±85.3 minutes) than with standard resection (140.4±104.8 minutes). There were no significant differences in complication profiles. In mixed effects models, ECoG utilization had a significant difference from standard resection on changes in mRS scores from baseline (figure), but no significant difference in seizure frequency or AED utilization.

Conclusions: We demonstrate that IoECoG is a safe adjunct to standard CCM lesionectomy. IoECoG procedures had longer surgical times, likely due to the added complexity of these operations. Longer time from seizure onset to CCM resection was predictive of IoECoG. Patients with solitary seizures and subacute hemorrhages were associated with standard resection. The relative improvement in mRS scores afforded by ECoG guided resection suggests that this approach may afford better outcomes in certain patient populations.

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Raymond Tien, OHSU	2002
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Hells Canyon is the deepest river-carved gorge in North America, deeper than even the Grand Canyon

Past Meetings of the Society

1. Biltmore Hotel, Santa Barbara, CA	Nov 25-26, 1955
2. Timberline Lodge, OR	Dec 9-11, 1956
3. Holiday Hotel, Reno, NV	Sept 29-Oct 1,1957
4. Del Monte Lodge, Pebble Beach, CA	Oct 19-22, 1958
5. La Valencia Hotel, La Jolla, CA	Sept 27-30, 1959
6. Del Monte Lodge, Pebble Beach, CA	Oct 23-26, 1960
7. Bayshore Inn, Vancouver, BC	Oct 29-Nov 1, 1961
8. Camelback Inn, Phoenix, AZ	Oct 28-31, 2962
9. El Mirador Hotel, Palm Springs, CA	Oct 20-23, 1963
10. Fairmont Hotel, San Francisco, CA	Oct 18-21, 1964
11. Olympic Hotel, Seattle, WA	Oct 3-6, 1965
12. Hotel Utah, Salt Lake City, UT	Nov 6-9, 1966
13. Kona Kai Club, San Diego, CA	Oct 15-18, 1967
14. Mauna Kea Beach Hotel, Kamuela, HI	Nov 16-19, 1968
15. Del Monte Lodge, Pebble Beach, CA	Oct 15-18, 1969
16. Bayshore Inn, Vancouver, BC	Oct 4-7, 1970
17. The Broadmoor, Colorado Springs, CO	Oct 31-Nov 3, 1971
18. The Skyline Country Club, Tucson, AZ	Oct 29-Nov 1, 1972
19. Airport Marina Hotel, Albuquerque, NM	Sept 16-19, 1973
20. Santa Barbara Biltmore Hotel, CA	Oct 27-30, 1974
21. Mauna Kea Beach Hotel, Kamuela, HI	Sept 28-Oct 1, 1975
22. Harrah's Hotel, Reno, NV	Sept 26-29, 1976
23. La Costa Resort Hotel, Carlsbad, CA	Sept 18-21, 1977
24. The Lodge, Pebble Beach, CA	Oct 8-11, 1978
25. Camelback Inn, Scottsdale, AZ	Sept 23-26, 1979
26. Mauna Kea Beach Hotel, Kamuela, HI	Sept 21-24, 1980
27. The Empress Hotel, Victoria, BC	Sept 20-23, 1981
28. Jackson Lake Lodge, Jackson Hole, WY	Sept 12-15, 1982
29. Hotel del Coronado, Coronado, CA	Oct 2-5, 1983
30. The Broadmoor, Colorado Springs, CO	Sept 9-12, 1984
31. Silverado Country Club & Resort, Napa, CA	Sept 22-25, 1985
32. Maui Intercontinental, Wailea, Maui, HI	Sept 28-Oct 1, 1986
33. Banff Springs Hotel, Banff, AB	Sept 6-9, 1987
34. Ritz-Carlton, Laguna Niguel, CA	Sept 11-14, 1988
35. The Lodge, Sun Valley, ID	Sept 10-13, 1989
36. Mauna Lani Bay Hotel, Kawaihae, HI	Sept 9-12, 1990
37. The Pointe, Phoenix, AZ	Sept 22-25, 1991
38. The Whistler, Whistler, BC	Sept 20-23, 1992
39. Mauna Lani Bay Hotel, Kawaihae, HI	Sept 19-22, 1993
40. Le Meridien Hotel, San Diego, CA	Sept 18-21, 1994

Past Meetings of the Society

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41. Salishan Lodge, Gleneden Beach, OR — Sept 9-12, 1995
42. Manele Bay, Island of Lanai, HI — Sept 14-17, 1996
43. Ojai Valley Inn, Ojai, CA — Sept 20-23, 1997
44. Silverado Resort, Napa, CA — Sept 12-15, 1998
45. Coeur d'Alene Resort, Coeur d'Alene, ID — Sept 18-21, 1999
46. Mauna Lani Bay Hotel, Hawaii, HI — Sept 9-11, 2000
47. Ocean Pointe Resort, Victoria BC (Cancelled) — Sept 15-18, 2001
48. Delta Victoria Resort, Victoria, BC — Oct 12-15, 2002
49. Hapuna Beach Prince Hotel, Kamuela, HI — Sept 20-24, 2003
50. Rancho Bernardo Inn, San Diego, CA — Sept 11-14, 2004
51. Squaw Creek Resort, Lake Tahoe, CA — Sept 17-20, 2005
52. Semiahmoo Resort & Spa, Blaine, WA — Sept 16-19, 2006
53. Mauna Lani Bay Hotel, Kawaihe, HI — Sept 8-11, 2007
54. Hotel Captain Cook, Anchorage, AK — Aug 16-19, 2008
55. Sun River Resort, Bend, OR — Sept 11-14, 2009
56. Eldorado Hotel, Santa Fe, NM *In Memory of L. Philip Carter* — Oct. 8-11, 2010
57. Grand Hyatt Kauai Resort & Spa, Kauai, HI — Sept 10-13, 2011
58. The Broadmoor, Colorado Springs, CO — Sept 7-11, 2012
59. Ritz Carlton Half Moon Bay, Half Moon Bay, CA — Sept 15-18, 2013
60. The Lodge, Sun Valley, ID — Aug 16-19, 2014
61. Grand Hyatt Kauai Resort & Spa, Kauai, HI — Sept 10-13, 2015
62. Park Hyatt Aviara, Carlsbad, CA — Sept 9-12, 2016
63. Fairmont Banff Springs Hotel, Banff, Alberta, Canada — Sept 8-11, 2017
64. Fairmont Orchid, Kona, HI — Sept 14-17, 2018
65. Hyatt Regency at Gainey Ranch, Scottsdale, AZ — Nov 8-11, 2019
66. Virtual Annual Meeting (Covid-19 Pandemic) — July 25, 2020
    And Special Virtual Scientific Meeting — Aug 29, 2020
67. Hyatt Tamaya, Santa Ana Pueblo, NM — Sept 10-13, 2021
68. Fairmont Orchid, Kohala Coast, HI — Sept 9-12, 2022
69. Portola Hotel & Spa, Monterey, CA — Sept 29-Oct 2, 2023
70. Fairmont Grand Del Mar, San Diego, CA — Sept 5-8, 2024

Future Meetings

72. Royal Sonesta Kauai Resort, Lihue, HI — Sept 24-27, 2026
73. Snow King Resort, Jackson Hole, WY — Sept 9-12, 2027
74. Loews Ventana Canyon Ranch, Tucson, AZ — Nov 2-5, 2028