Tumor NEWS

American Association of Neurological Surgeons

Fall 2016

AANS/CNS Section on Tumors

Editor: Ian Lee, MD, Assistant Editor: Pamela Jones, MD • www.TumorSection.org • Follow us on Twitter: @Tumorsection

In This Issue...

Specific Goals for the 2016-2018 Term The section's goals include the following:

Greetings, and Welcome to the Fall 2016 AANS/CNS Section on Tumors Newsletter!

Steven N. Kalkanis, MD, FAANS
Chair, Section on Tumors

Dear Colleagues:

It has been the honor of a lifetime to begin my term as chair of the AANS/CNS Section on Tumors, founded in 1984 by my mentor at Henry Ford, Mark Rosenblum, MD, FAANS(L). I have been blessed with incredible role models in my neurosurgical career thus far; my predecessor, Fred G. Barker II, MD, FAANS, led us into a new era of unprecedented growth and relevance in organized neurosurgery, and Dr. Barker was also one of my earliest tumor mentors when I trained at the MGH. Indeed, mentorship serves as a powerful and enduring bond among all of us who pursue the calling of neurosurgery, and my strategic initiatives over the next two years will intensely focus on continuing to transform the Section into a beacon of mentorship, innovation and best-practice expertise for our growing worldwide membership.

Specific goals for the 2016-2018 term include the following:

- Foster premier mentoring opportunities so that Section membership becomes the obvious, must-have affiliation for senior residents and junior faculty to be matched with senior mentors for critical career advice. To this end, we are thrilled to announce the inauguration of the Parsa Mentorship Award to honor the legacy of Andrew Parsa, MD, PhD, FAANS, who passed away suddenly in April 2015, shortly before he would have become Section chair. At our satellite meeting in San Diego, the first annual Andrew Parsa Mentorship Award was presented by Isabelle Germano, MD, FAANS, and Manish Aghi, MD, PhD, FAANS, to an individual with an exceptional track record for mentoring trainees and junior faculty, Dr. Fred Barker.
- Focus on specific academic career advising activities for young neurosurgeons in terms of how to start a practice, setup a lab, apply for grants, maximize protected time, negotiate contracts and become more involved in organized neurosurgery
- Expand our young neurosurgeons event at the annual meetings into a potential job match and formal networking event with senior leadership present, including fellowship directors
- Given the leadership role the Section has played in the development of neurosurgical clinical practice guidelines, transform our committee into a central, coordinating adjudicator of all brain tumor-related guidelines from other societies, by specifically reaching out to ASTRO, SNO, AAN and others to ensure multidisciplinary collaboration; we should also create a framework for assessing if guidelines are in fact used in practice and what impact they have on patient outcomes
- Enhance our leadership role in clinical trial development and enrollment by collaborating with ABTC, Alliance, NRG and others to help spearhead surgical investigator trials for brain tumors

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- Exceed the $1 million fundraising goal for the newly minted Parsa Fellowship to help launch academic careers and unique training experiences for young tumor neurosurgeons globally

In order to accomplish these goals, Dr. Aghi, secretary treasurer of the Section, and I convened a new executive committee and advisory board for the 2016-2018 term. I want to thank all of our esteemed colleagues for accepting important leadership roles, and I especially want to acknowledge the incredible efforts of Dr. Aghi in strategic planning and of Dr. Barker for his important historical perspectives as immediate past chair. Highlights from the new EC include dramatic expansion of the Awards, Communications/Website, Development and Guidelines committees, with a near-doubling of the International Committee to include representatives from every continent and major world society. I also added an education and practice assessment scientific chair position to help further our programmatic goals, and we created new regional membership directors and member services representatives, in addition to newly minted prize stewardship, immunology and simulation/technology committees. A full listing of our committees and section leadership is included on the final page of the newsletter.

Tumor Satellite Symposium

Our first major event of the new term, the biennial Tumor Section Satellite Symposium, was held in San Diego, on Sept. 23-24, immediately preceding the 2016 CNS annual meeting. Over 60 speakers shared new advances. Scientific Program Chairs Chetan Bettegowda, MD, and Brian Nahed. MD, assembled a spectacular program highlighting innovative developments in the management of Low Grade Gliomas. We are delighted that the three keynote speakers at this year's meeting were Mitchel S. Berger, MD, FAANS; Hughes Duffau, MD; and James T. Rutka, MD, PhD, FAANS, all world-renowned pioneers in the management of low grade gliomas and multi-modality, maximal safe resection.

At the Tumor Section Gala Dinner in San Diego, we honored the lifetime achievement of Dr. Berger by presenting him with the Charles B. Wilson award, making him the sixth winner of this prestigious award since its inception in 2004. Joseph Piepmeier, MD, FAANS, received the Distinguished Service Award at the symposium, in recognition of his legacy of exceptional service to the Section from 1993 to 2016, including serving as chair from 1999-2001. Finally, we presented the first Andrew Parsa Mentorship Award on behalf of the Tumor Section to Dr. Fred Barker.

Held for the first time in conjunction with the CNS Annual Meeting, the symposium featured a discussion of advances in low grade glioma as well as adjuvant therapy, ionizing radiation treatment, surgical techniques, clinical trials and guidelines. Breakout groups specifically for residents, fellows and young attendings focused on topics, such as how to become a clinical trial investigator or how to find an academic position as a brain tumor surgeon. This year, Zeiss also partnered with us to offer a special lunch seminar on the controversies in fluorescence-guided surgery of gliomas with the use of 5-ALA and Fluoroscein.

CNS Annual Meeting

Immediately following the tumor satellite symposium, the Tumor Section sponsored two major scientific sessions at the CNS annual meeting on Monday and Tuesday, Sept. 26-27. Under the direction of scientific program chairs Ian Lee, MD, FAANS, and Ekkehard Kasper, MD, PhD, FAANS, the Section presented an in-depth session on Immunotherapy for GBMs, including viral and vaccine therapies, checkpoint inhibitor and antibody treatments and another comprehensive session on ependymoma, including current molecular classifications, surgical management and adjuvant therapy.

The Tumor Section remains active in the production of guidelines for the management of brain tumors under the direction of Jeff Olson, MD, FAANS. We are proud to share that new guidelines on the management of nonfunctional pituitary adenomas have just been released, an effort led by Dr. Aghi, and endorsed by the AANS/CNS Joint Guidelines Committee. Read the executive summaries in the October issue of *Neurosurgery* and access the full chapters at cns.org/guidelines.

Finally, looking forward to 2017, we would like to announce that 2015-16 CNS President Russell L. Lonser, MD, FAANS, has been invited to deliver the Ronald L. Bittner Lecture at the AANS Annual Scientific Meeting on Monday, April 24, 2017, in Los Angeles. The tumor section will also continue to work to advance partnerships internationally, with two Joint Tumor Section and World Federation of Neurologic Surgeons (WFNS) courses planned for 2017 at host institutions from around the world on topics to be determined. For the latest details on Tumor Section activities and for information on becoming a member, please visit our website at www.tumorsection.org.

Sincerely,

Steven N. Kalkanis MD, FAANS
Chair, Section on Tumors

CNS 2016 Update

Ian Lee, Ekkehard Kasper

The themes of the Scientific Session on Tumors at the 2016 CNS Annual Meeting were current diagnosis and management of ependymomas and immunotherapies for glioblastoma. The molecular basis for ependymoma has been an area of furious investigation recently. Given the recent advances, a session on the state-of-the-art in the diagnosis and management of ependymoma was timely. The speakers for the session were Mark Gilbert, MD; Frederick A. Boop, MD, FAANS; and Kristian Patjler.

The second day included a series of lectures on current immunotherapy strategies for glioblastoma, also a hot topic of investigation. The lectures were given by Linda Liau, MD, PhD, FAANS; Ian Parney, MD, PhD, FAANS; and Michael Lim, MD, FAANS. Both sessions were well attended and received. These themed sessions were then followed by oral presentations for the highest scoring abstracts, which were all excellent. New for this year were rapid fire oral abstracts, which were presented on Tuesday and Wednesday. Each of the presentations was limited to three minutes and intended to allow more speakers, especially trainees, to participate as well as gain experience speaking in these types of forums. They were also well-done and are a welcome addition to the meeting.

Tumor Symposium Highlights

Brian Nahed, Chetan Bettegowda

The AANS/CNS 12th Biennial Satellite Tumor Symposium was held in advance of the 2016 CNS Annual Scientific Meeting on Sept. 23-24 in San Diego. A total of 220 clinicians, scientists and trainees attended the meeting. The theme of this year's symposium was "Low Grade Gliomas - Management Strategies and Innovations" and focused primarily on the biology and advances in surgery, chemotherapy and radiation oncology. In addition to the focus on adult low grade gliomas, there was a special session focusing on advances in pediatric low grade gliomas. These oral abstract presentations highlighted a broad range of exciting basic, translational and clinical research in tumor biology. The symposium featured keynote lectures by Mitchel S Berger, MD, FAANS; Hughes Duffau, MD; and James T. Rutka, MD, PhD, FAANS.

Three well-attended breakfast breakout seminars on the timely topics of developing an independent research program as a neurosurgeon, finding a neurosurgery position as a brain tumor surgeon and neurosurgeons as clinical trial investigators – all of which provided practical guidance to residents, fellows and junior attendings. The Tumor Symposium's spectacular gala dinner at the historic U.S. Grant Hotel commemorated the 31st anniversary of the AANS/CNS Tumor Section. Overseen by Tumor Section President Steven Kalkanis MD, FAANS; and Secretary Treasurer Manish Aghi, MD PhD, FAANS; this celebration included recognition of the Wilson Award awarded to Dr. Berger, Distinguished Service Award to Joe Piepmeier, MD, FAANS, and the Mentoring Award to Fred Barker, MD, FAANS. The evening was a highlight of the satellite meeting.

Education Committee Update

By Jason Sheehan, MD, PhD, FAANS; and Costas G. Hadjipanayis, MD, PhD, FAANS

The Tumor Section hosted its satellite symposium Sept. 23-24, 2016, in San Diego. The symposium preceded the 2016 Congress of Neurological Surgeon's (CNS) Annual Meeting. The Section event explored recent innovations and advances in the treatment of patients with low-grade gliomas. Additional sessions covered topics including adjuvant therapy, ionizing radiation treatment, surgical techniques, clinical trials and guidelines. Keynote speakers included Mitchel S. Berger, MD, FAANS; Hugues Duffau, MD; and James T. Rutka, MD, PhD, FAANS. Educational seminars also focused on such diverse topics as how to become a clinical trial investigator and to find an academic position as a brain tumor surgeon. Participants presented scientific research as abstracts and digital posters. There was also a special lunch seminar, sponsored by Zeiss, that focused on the controversies in fluorescence-guided surgery of gliomas with the use of 5-ALA and Fluoroscein. An international and national expert panel took part in this seminar.

The American Association of Neurological Surgeons (AANS) and American Society for Radiation Oncology (ASTRO) are hosting a senior resident training course at the University of Pittsburgh in June 2017. L. Dade Lunsford, MD, FAANS, along with John Suh, MD, and Jason Sheehan, MD, PhD, FAANS, will direct the course. The intensive course will cover intracranial and spinal radiosurgery with a focus on tumor-related topics. Program directors are asked to nominate senior neurosurgical residents by contacting Joni L. Shulman at jls@aans.org at the AANS. Educational grants will cover the expenses of those residents participating in the course.

Medical Neuro-Oncology Update-Summary of the ASCO 2015 Annual Scientific Meeting

By Susan Chang, MD

The overall theme of the ASCO 2015 annual meeting was "Illumination and Innovation-Translating Data into Learning." The presentations focused on brain tumors and were good examples of how new scientific discoveries are being incorporated into clinical care.

The management of patients with brain metastases was highlighted in the scientific plenary session. On behalf of the Alliance cooperative group, Dr. Paul Brown presented the results of NCCTG NO574, a randomized trial of whole brain radiotherapy in addition to radiosurgery vs radiosurgery for patients with one to three brain mets. Although whole brain radiation therapy (WBRT) improved brain control there was no improvement in overall survival. There was however worse QOL as well as a decline in cognitive function in the WBRT group. The recommendation was for initial treatment with radiosurgery alone and to monitor closely to preserve cognitive function and QOL.

The topic of brain metastases was also the focus of an education session that outlined the results of clinical trials that could be translated to practice. Presentations included the understanding of molecular biology of brain metastases and the implications for therapy, the role of radiation strategies and tailored approach of immunotherapy and targeted therapy.

Another education session reviewed the emerging topics in immunotherapy and cellular therapy and, in addition to a review of immunotherapy for childhood leukemia and solid tumor, Ian Pollack, MD, FAANS, summarized the exciting results of early trials in CNS tumors. These range from antigen targeting, adoptive immune transfer and anti-inhibitory approaches. Building on this presentation, a clinical science symposium highlighting these clinical trial efforts was also a major part of the CNS educational offerings at the annual meeting. The trials discussed included the use of vaccines targeting the epidermal growth factor receptor VIII and the heat shock protein peptides as well as a gene mediated cytotoxic immunotherapy approach. For these studies, the next steps are to identify the patient populations who may best benefit from these strategies, e.g. patients who are able to undergo an extensive resection with minimal residual disease. These studies also highlighted the challenges in determining response to these treatments and the recently formed immunotherapy response assessment in the neuro-oncology (iRANO) group led by Hideho Okada, MD, PhD, and David Reardon, MD, who are working on standardizing the criteria for immunotherapy clinical trials.

The updated results of a novel treatment strategy of alternating electric field therapy for newly diagnosed glioblastoma were also presented at the meeting. This treatment targets the microtubule and spindle apparatus critical for cell division and is FDA approved for patients with recurrent GBM. The trial results from the randomized trial in newly diagnosed GBM show an advantage in both the time to progression as well as overall survival and suggest an additional strategy for treatment. Several studies reported on the importance of the molecular and cytogenetic characterization of tumors for prognosis and the implications for treatment selection. Bevacizumab targets the abnormal blood vessels in the growing tumor and is FDA approved for recurrent GBM. Several papers evaluated the dose schedule and duration of administering this agent in conjunction with chemotherapy or targeted agents. There does not appear to be an advantage in terms of survival to continuing bevacizumab following progression, nor does it seem to matter if the dose intensity is decreased. It is still a challenge to determine who may benefit from treatment with this agent and studies are ongoing.

Although most of the presentations were focused on malignant glioma and metastatic disease, there was also an education session discussing rare tumors of the CNS and how studying these tumors of neurogenetic syndromes can inform on our practice. The three presentations included challenges in drug development in meningioma; neurofibromatosis 2 as a model for integrating genetics and functional endpoints for multiple nervous system tumors; and research in ependymoma.

Overall, the presentations highlight the importance of basic science and translational research to improve our understanding of the complexity of brain tumors as well as the multidisciplinary team of clinicians that are critical for testing new strategies in the clinic.

Tumor Section Award Update: Fall 2016

Isabelle M. Germano, MD, FAANS

The Tumor Section Awards Committee continues to actively develop the most robust awards program for outstanding research of any of the AANS/CNS joint sections. Each year, we give 12 awards plus one named lectureship at the AANS Annual Scientific Meeting and nine awards plus one lectureship every-other-year at the CNS annual meeting. Additionally, we offer three awards at our Biennial Tumor Satellite Symposia. The AANS/CNS Section on Tumors would like to thank the award sponsors for helping to encourage submission of the highest quality work in neuro-oncology. Most of the awards are limited to Tumor Section members, providing an additional incentive for membership.

The 12 award winners and one named lectureship award winner recognized at the 2016 AANS Annual Scientific Meeting are shown below. Congratulations to each winner! The section is looking forward to recognizing the nine award winners at the 2016 CNS Annual Meeting, as summarized in the table below. Congratulations!

This year, in addition to the Distinguished Service Award and the Charles B. Wilson Award, a third award was added: the Andy T. Parsa Mentorship Award. This biennial award, proposed by Isabelle M. Germano, MD, FAANS, was established in honor of Andrew T. Parsa, MD, PhD, FAANS, who passed away on April 13, 2015, shortly before he was to become the chair of our Joint Section. Dr. Parsa was a renowned brain tumor neurosurgeon, innovative researcher and dedicated mentor. He was an exceptional teacher both in the operating room as well as in the clinic making everyone around him feel like a valuable member of the team. He was famously approachable and eager to help those in need. Combining an energetic style, brilliant insights and passion for teaching, he transformed the cultures of the places where he worked, establishing lifelong and committed relationships with collaborators and colleagues. The three award winners will be announced during The Tumor Section Satellite Symposium. Join us to celebrate the awardees!

Congratulations to the 2016 CNS Tumor Section Award Winners

Award	Name	Presentation Title
National Brain Tumor Society Mahaley Clinical Research Award	Pascal O. Zinn, MD, PhD	Clinically Applicable and Biologically Validated MRI Radiomic Test Method Predicts Glioblastoma Genomic Landscape and Survival
BrainLab Neurosurgery Award	Imran Noorani	Genome-wide CRISPR/cas9 Knock-out Screens in Human Glioblastoma Identify Genetic Vulnerabilities
Journal of Neuro-Oncology Award	Andrew E. Sloan, MD, FAANS	Phase I Trial of Genetically Modified Hematopoietic Progenitor Cells (HPC) Facilitate Bone Marrow Chemoprotection and Enabling TMZ/O6BG Dose Escalation Resulting in Improved Survival
American Brain Tumor Association Young Investigator Award	Gavin P. Dunn, MD, PhD	Identification of Neoantigen-specific CD8+ T Cells in Two Murine Orthotopic Glioblastoma Models Using Cancer Immunogenomics
Preuss Award	Dimitris Placantonakis, MD, PhD, FAANS	GPR133 Promotes Glioblastoma Growth in Hypoxia
Stryker Neuro-Oncology Award	Hormuzdiyar H. Dasenbrock, MD	Unplanned Reoperation After Craniotomy for Tumor: A National Surgical Quality Improvement Program Analysis
Integra Foundation Award	Prashant Chittiboina, MD, MPH	HDAC Inhibitor Vorinostat is a Novel, Promising Treatment for Cushing's Disease
Synthes Skull Base Surgery Award	Aurel Hasanbelliu	Expanded Anterior Petrosectomy Through the Transcranial Middle Fossa and Extended Endoscopic Transphenoidal-Transclival Approaches: Qualitative and Quantitative Anatomic Analysis
Columbia Softball Charity Award	Jennifer Quon, MD	Transnasal Endoscopic Approach for Pediatric Skull Base Tumors: A Case Series

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American Brain Tumor Association Young Investigator Award

Viviane S. Tabar, MD, FAANS is the recipient of the ABTA Young Investigator Award AANS 2016

Viviane S. Tabar, MD, FAANS, was the winner of the American Brain Tumor Association (ABTA) Award for the work entitled: "From Bench to Bedside: Results of a Phase I trial using a Notch inhibitor for Glioblastoma," presented during the Tumor Section II on Wednesday May 4, 2016.

Sponsored by the ABTA, the Young Investigator Award is given at the AANS Annual Scientific Meeting and the CNS annual meeting to a young faculty member involved in neuro-oncology research who has demonstrated outstanding potential for future basic science research. The applicant must have been out of training for less than six years. A $2,000 honorarium accompanies this award.

Ronald Bittner Award

Christopher Paul Deibert, MD, receives the Bittner Award from Gelareh Zadeh, MD, PhD, Tumor Section Scientific Program chair; and Randy Jensen, MD, PhD, FAANS, Tumor Section membership chair.

Christopher Paul Deibert, MD, was the winner of the Bittner Award for the work entitled: "IDH Mutant Gliomas Escape Natural Killer Cell Immune Surveillance Through Downregulation of NKG2D Ligands," presented during the Tumor Section I on Tuesday May 3, 2016.

This award is endowed by Mrs. E. Laurie Bittner in memory of her husband, Ronald L. Bittner. It is awarded to the best abstract paper submitted to the AANS Annual Scientific Meeting on Brain Tumor research by a resident or a junior faculty member. This award includes a $1,000 honorarium.

Bittner Lecture

Michael D. Taylor, MD, PhD, delivered the Bittner Lecture

At the 2016 AANS Annual Scientific Meeting, the Bittner Lecture was delivered by **Michael D. Taylor, MD, PhD**.

In addition to the Ronald Bittner Award, the Bittner Family Foundation sponsors an annual Bittner Lectureship awarded by the AANS at its Annual Scientific Meeting. The lectureship is awarded to an established investigator and is presented during the main scientific program.

Selection of the Bittner Lecturer is made by the Senior Scientific Program Committee of each AANS Annual Scientific Meeting. The 2017 winner will be selected shortly before the 2017 AANS Annual Scientific Meeting.

BrainLab Community Neurosurgery Award

Hirokazu Takami, MD, PhD, was awarded the BrainLab Community Neurosurgery AANS 2016.

Hirokazu Takami, MD, PHD, was the winner of the BrainLab Community Neurosurgery Award for the work entitled: "Clinical profiles of 132 cases of intracranial germ cell tumors of the iGCT Consortium," presented during the Scientific Session I on Monday May 2, 2016.

The Brainlab Neurosurgery Award is presented at the AANS Annual Scientific Meeting and the CNS annual meeting. This award is given to a neurosurgeon practicing in a nonacademic or international setting with the best abstract related to central nervous system tumors. Previous AANS/CNS Section on Tumors chairs Michael McDermott, MD, FAANS, and Ronald Warnick, MD, FAANS, were instrumental in securing this award given through the generosity of BrainLAB. The award carries an honorarium of $1,000.

Columbia Softball Charity Award

Ian F. Pollack, MD, FAANS, was awarded the Columbia Softball Charity Award

Ian F. Pollack, MD, FAANS, was the winner of the Columbia Softball Charity Award for the work entitled: "Immune responses and clinical outcome after glioma-associated antigen vaccination in children with recurrent low-grade gliomas," presented during the Plenary Session I on Monday May 2, 2016.

The Columbia Softball Charity Award is given to the best pediatric tumor abstract submitted by a resident or faculty member who is a member of the Section on Tumors at the AANS Annual Scientific Meeting and the CNS annual meeting. The section would like to acknowledge previous section chairs Jeff Bruce, MD, FAANS, Fred Barker, MD, FAANS, and Rich Anderson, MD, FAANS, for putting together the plan to use a portion of the proceeds from the annual tournament to support this award. The award carries an honorarium of $1,000.

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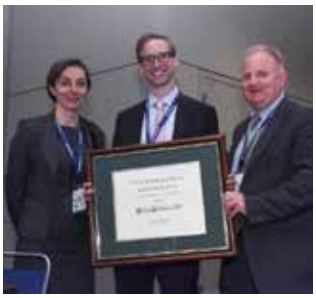
Integra Foundation Award

Jeremy Steinberger, MD, was the winner of the Integra Award at the AANS 2016 for the presentation: "Morbidity and Mortality of Meningioma Resection Increases in Octogenarians," presented during the Tumor Section I on Tuesday May 3, 2016.



Jeremy Steinberger, MD, receives the Integra from Gelareh Zadeh, MD, PhD, Tumor Section Scientific Program chair; and Randy Jensen, MD, PhD, FAANS, Tumor Section Membership chair

The Integra Foundation Award, sponsored by the Integra Foundation, is given at both the AANS and CNS meetings for the best research or clinical paper submitted investigating benign brain, spinal or peripheral nerve tumors. The award carries an honorarium of $1,000.

Leksell Radiosurgery Award

Anthony L. Asher, MD, FAANS, was the winner of the Leksell Award for the presentation entitled: "Cognitive Decline with Whole Brain Radiotherapy after Radiosurgery for Metastases," during the Scientific Session I, Tumors on Monday May 2, 2016.

Anthony L. Asher, MD, FAANS, was awarded the Leksell Radiosurgery Award

This award, presented at each AANS Annual Scientific Meeting, is for the best paper on stereotactic radiosurgery related to brain tumors, given through the generosity of Elekta. The award includes a monetary component of $2,000.

National Brain Tumor Society Mahaley Award

John H. Sampson, MD, PhD, FAANS, was the winner of the National Brain Tumor Society Award for the presentation entitled:" ReACT: A Randomized Phase II Study of Rindopepimut (CDX-110) plus Bevacizumab in Relapsed Glioblastoma," presented during the Scientific Session I on Monday May 2, 2016.

John H. Sampson, MD, PhD, FAANS, was awarded the NBTS Mahaley Award

The NBTS Mahaley Award is given at the AANS and the CNS annual meetings to a neurosurgery resident, fellow or attending physician who submits the best clinical study in neuro-oncology. The award carries a $1,000 honorarium.

Preuss Award

Andrew Venteicher, MD, PhD, was the winner of the Preuss Award for the work entitled: "Cellular architecture of human IDH1-mutant gliomas revealed using single-cell RNA sequencing," presented during the Plenary Session III on Wednesday May 4, 2016.

Andrew Venteicher, MD, PhD, receives the Preuss Award from Frederick A. Boop, MD, FAANS, AANS 2017 president.

Sponsored by the Preuss Foundation, the Preuss Award is given to a young scientist investigating brain tumors, within 10 years of training, who has submitted the best basic science research paper. This award has a $1,000 honorarium.

The Brian D. Silber Award

Ganesh Mani Shankar, MD, was the winner of the Brian D. Silber Award for the work entitled: "BRAF alteration status and the histone H3F3A gene K27M mutation segregate spinal cord astrocytoma histology," presented during the Tumor Section II on Wednesday May 3, 2016.

Ganesh Mani Shankar, MD, was awarded the Silber Award at the AANS 2016.

Established in 2015, this award is given to the best abstract related to vertebral column or spinal cord tumors at the AANS annual meeting. The section would like to thank the family of Brian D. Silber, who passed away in 1996 at the age of 28 from a malignant spinal cord tumor, for their generous support of this award. The award has a $1,000 honorarium.

The Springer Journal of Neuro-Oncology Award

Arman Jahangiri, was the winner of the Springer Journal of Neuro-Oncology Award at the AANS 2016 for the work entitled: "From bench to bedside: NIH funding for neurosurgeons from 1991-2015," presented during the Scientific Session VII AANS/CSNS Socioeconomic on Monday May 2, 2016.

Arman Jahangiri was awarded the Springer JNO Award.

The Springer *Journal of Neuro-Oncology* Award is presented to a highly-ranked abstract in either clinical or basic science as related to neuro-oncology. Sponsored by the generosity of Springer, this award carries a $1,000 honorarium.

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Stryker Neuro-Oncology Award

Kristen A. Batich, was the winner of the Stryker Neuro-Oncology for the presentation entitled: "CMV-targeted Dendritic Cell Vaccines Increase Survival for Randomized Patients with Glioblastoma in Successive Trials" presented during the Plenary Session II on Tuesday May 3, 2016.

Kristin Batich receives the Stryker Neuro-Oncology Award from Aviva Abosch, MD, PhD, FAANS, AANS 2016 Scientific Program chair

The Stryker Neuro-Oncology Award is given to a high-ranking brain tumor clinical or basic science abstract submitted by a resident or medical student. The award is presented at the AANS Annual Scientific Meetings and the CNS annual meetings. The senior author of the paper must be a member of the AANS/CNS Section on Tumors. The award sponsored though the generosity of Stryker has a $1,000 award certificate.

Synthes Skull Base Award

Nathan T. Zwagerman, MD, was the winner of the Synthes Skull Base Award at the AANS 2016 for the presentation entitled: "A Prospective, Randomized Control Trial for Lumbar Drain Placement after Endoscopic Endonasal Skull Base Surgery," presented during the Tumor Section I on Tuesday May 2, 2016.

Nathan T. Zwagerman, MD, was awarded the Synthes Skull Base Award.

The Synthes Skull Base Award is given to an attending neurosurgeon, resident or fellow in the Tumor Section who submits the best abstract related to skull base surgery. Franco DeMonte, MD, FAANS, chair of the Skull Base Committee, was largely responsible for obtaining this award through a generous contribution from the Synthes Corporation. The award includes a $1,000 honorarium.

AANS 2016 Update

Matt Tate, MD, PhD; Gelareh Zadeh, MD, PhD

For the 2016 American Association of Neurological Surgeons (AANS) Annual Meeting, Tumor Section Program chairs Matt Tate, MD, PhD, and Gelareh Zadeh, MD, PhD, assembled an exciting program. The annual Ronald L. Bittner lecture was delivered by speaker Michael Taylor, MD, PhD, entitled "Heterogeneity Through Space and Time Drive the Clinical Behaviour of Childhood Posterior Fossa Tumors."

The Tuesday and Wednesday afternoon sessions were designed with two themes: Tuesday afternoon's Tumor Section was dedicated to the topic of precision medicine, with a team of internationally recognized speakers, including Ken Aldape, MD (Integrating "OMICS" into clinical practice); Don Berry, PhD (iSPY and related designs for clinical trials of targeted antitumor agents); Roel Verhaak, PhD ("DIY" genomic analysis); and Amy Heimberger, MD, FAANS (immunotherapy) speaking on this timely topic in neuro-oncology. The afternoon wrapped up with an interactive tumor board discussing key molecular diagnostics and their clinical application. Additionally, the outcome of the WHO survey conducted through SNO membership was presented by Dr. Zadeh.

Wednesday afternoon focused on surgical advances and innovations in technology as applied to tumor resection, covering a range of technologies, including 5-ALA (Costas Hadjipanayis, MD, PhD, FAANS); intraoperative MRI (Manish Aghi, MD, PhD, FAANS); convectionenhanced delivery (Michael Vogelbaum, MD, PhD, FAANS); high-frequency focused ultrasound (Dr.Zadeh); and laser therapeutics (Gene Barnett, MD, MBA, FAANS), summed up by Colin Watts, PhD, speaking on the role of the specialist tumor neurosurgeon in the multidisciplinary treatment of malignant gliomas.

Membership Update

Randy Jensen, MD, PhD, FAANS; Jennifer Moliterno Gunel, MD

Under the leadership of our Section on Tumors chair, Steven Kalkanis, MD, FAANS, a new committee has been created. The Member Services and Outreach Committee is a new group focusing on developing new ways to increase the reach, relevance and satisfaction our members while helping to increase membership. It will be chaired by Randy Jensen MD, PhD, FAANS, and members include:

Gabriel Zada, MD, FAANS	West Coast Membership Director
Brad Elder, MD, FAANS	Midwest Membership Director
Edjah Nduom, MD	East Coast Membership Director and Social Media
Gavin Dunn, MD, PhD	Mentor and Job Match Program

The members of this committee look forward to serving the Section on Tumors members and finding new individuals for membership in our group.

Below are the latest statistics of membership for the Section on Tumors in recent years.

Tumor Section Membership Statistics: July 21, 2016

Class Code	Subclass Code	Status	# of Members
ASSOCIATE	15D	$ 0.0	70
ADJUNCT	60D	$ 37.50	24
ACTIVE	01S	$ 150.00	537
INTERNATIONAL	40S	$ 150.00	62
INTERNATIONAL DEVELOPING COUNTRY	40SD	$ 75.00	10
HONORARY	45S	$ 0.0	20
MEDICAL STUDENT	15M	$ 0.0	9
RESIDENT/FELLOW	50R	$ 0.0	1,648

April 8, 2015

Class Code	Subclass Code	2015 Dues	2015 Members
ASSOCIATE	15D	ACTIVE	68
ADJUNCT	60D	ACTIVE	23
ACTIVE	01S	ACTIVE	542
INTERNATIONAL	40S	ACTIVE	62
INTERNATIONAL DEVELOPING COUNTRY	40SD	ACTIVE	8
HONORARY	45S	ACTIVE	20
MEDICAL STUDENT	15M	ACTIVE	3
RESIDENT/FELLOW	50R	ACTIVE	1,666

Class Code	Subclass Code	2014 Members	2013 Members	2012 Members	2011 Members
ASSOCIATE	15D	68	72	72	n/a
ADJUNCT	60D	24	27	24	26
ACTIVE	01S	539	581	567	577
INTERNATIONAL	40S	63	69	62	58
INTERNATIONAL DEVELOPING COUNTRY	40SD	0	0	0	0
HONORARY	45S	20	20	20	n/a
MEDICAL STUDENT	15M	0	0	0	0
RESIDENT/FELLOW	50R	1561	1693	1851	n/a

NRG Update

Daniel Cahill, MD, PhD, FAANS

NRG Liason
Tumor Section
Sept 2016 Committee Report

Herein, we report on the interactions between the Tumor Section and NRG Oncology. Now coming up on three years of integration, the National Cancer Institute (NCI)-funded cancer clinical cooperative group, NRG Oncology, was formed by the unification of the National Surgical Adjuvant Breast and Bowel Project (NSABP), the Radiation Therapy Oncology Group (RTOG) and the Gynecologic Oncology Group (GOG) in 2014. The three legacy groups have transitioned NCI-supported trial oversight as independent but collaborative entities during the integration. The NRG Neurosurgical Committee participates in the development and recruitment to clinical trials focused on patients with brain tumors.

In the Tumor Section newsletter, we highlight an interesting study for glioblastoma patients, NRG-BN001, which has relevance for neurosurgeons. Local failure remains a significant problem with glioblastoma. Intensification of local radiation therapy, through concomitant escalation of radiotherapy dose and dose per-fraction is an approach thought to help overcome local failure. Prior dose escalation studies with radiotherapy alone suggest that the pattern of failure can be altered and local control improved with radiotherapy dose escalation. Though prior studies of focal radiotherapy boost techniques, such as radiosurgery and brachytherapy have failed to show a survival benefit, the impact of local therapy intensification has not been addressed in the context of concomitant temozolomide, a radiotherapy sensitizer and chemotherapeutic agent that has demonstrated improved survival when delivered with radiotherapy.

Thus, this NRG Oncology trial aims to determine if dose-escalated and dose-intensified photon IMRT or proton beam therapy with concomitant and adjuvant temozolomide improves overall survival, as compared to standard-dose photon irradiation with concomitant and adjuvant temozolomide. To this end, after registration and stratification by RPA class and MGMT status, patients at proton centers will be randomized to receive either a "reference arm" of photon irradiation using 3DCRT or IMRT to 46Gy in 23 fractions followed by a sequential boost for an additional 7 fractions to 60Gy, plus comcomitant and adjuvant temozolomide, or proton dose-intensified irradiation 50 Gy(RBE) in 30 fractions with a simultaneous integrated boost to 75 Gy(RBE) in 30 fractions, plus comcomitant and adjuvant temozolomide. For photon centers, there will be a randomization including the same reference arm, but the dose-intensification arm will be Photon dose-intensified irradiation using IMRT: 50 Gy in 30 fractions with a simultaneous integrated boost to 75 Gy in 30 fractions, plus comcomitant and adjuvant temozolomide.

Importantly for neurosurgeons, the protocol eligibility requires "Histologically proven diagnosis of glioblastoma (WHO grade IV) confirmed by central review prior to step 2 registration. Tumor tissue that is determined by central pathology review prior to step 2 registration to be of sufficient quantity for analysis of MGMT status. The tumor must be located in the supratentorial compartment only (any component involving the brain stem or cerebellum is not allowed)." Thus, biopsy-only cases or partial resections, where only a small specimen remains for pathologic analyses, will not be sufficient to qualify for trial candidacy.

Neurosurgeons are key contributors for patient enrollment in this trial through the identification of glioblastoma patients who are surgically resectable and therefore can meet enrollment criteria.

With regards to the Tumor Section, we look forward to further productive interaction between the neuro-oncology community and the NRG trial group to continue support of phase III trials in glioblastoma. The upcoming NRG Oncology meetings are Feb. 9-12, 2017, at the Marriott Marquis Houston in Houston, and July 13-16, 2017, at the Philadelphia Marriott Downtown in Philadelphia. Any member of the Tumor Section who might be interested participating in this currently active trial research effort should contact Dan Cahill, MD, PhD, FAANS, at cahill@mgh.harvard.edu or chair of the NRG Neurosurgery Committee, Michael Vogelbaum, MD, PhD, FAANS, at vogelbm@ccf.org.

Report From the Alliance for Clinical Trials in Neuro-oncology

The AANS/CNS Tumor Section has implemented a collaboration with the Alliance for Clinical Trials in Oncology to facilitate cooperative efforts between neurosurgeons, neuro-oncologists and radiation oncologists at the national level in an effort to more efficiently support neuro-oncology clinical trials. Each issue of the Tumor Section Newsletter will highlight a clinical trial that is being sponsored by the Alliance or presented at one of the semi-annual meetings which may be of interest to neurosurgeons. Additional information regarding the Alliance is available on the website allianceforclinicaltrialsinoncology.org.

Past report highlights:

- A Phase II Randomized Trial Comparing the Efficacy of Heat Shock Protein-Peptide Complex-96 (HSPPC-96) (NSC #725085, ALLIANCE IND # 15380) Vaccine Given With Bevacizumab Versus Bevacizumab Alone in the Treatment of Surgically Resectable Recurrent Glioblastoma Multiforme (GBM).
  - PI: Andrew T. Parsa, MD, PhD; Northwestern University Medical Center
- Clinical Trial: A Phase III Trial of Post-Surgical Stereotactic Radiosurgery (SRS) Compared With Whole Brain Radiotherapy (WBRT) for Resected Metastatic Brain Disease NCT01372774 (Alliance ID: N017C)
  - PI: Paul D. Brown, MD; M.D. Anderson Cancer Center
- Phase III Intergroup Study of **Temozolomide** Alone Versus Radiotherapy With Concomitant and Adjuvant **Temozolomide** Versus Radiotherapy With Adjuvant PCV Chemotherapy in Patients With 1p/19q Co-deleted **Anaplastic** Glioma
  - PI: Kurt Jaeckle, MD; Mayo Clinic
- Phase I/Comparative Randomized Phase II Trial of TRC105 Plus Bevacizumab Versus Bevacizumab in Bevacizumab-Naïve Patients With Recurrent Glioblastoma Multiforme
  - PI: Evanthia Galanis, MD; Mayo Clinic
- A phase II/III randomized trial of veliparib or placebo in combination with adjuvant temozolomide in newly diagnosed glioblastoma with MGMT promotor hypermethylation
  - PI: Jann Sarkaria, MD at Mayo Clinic

The clinical trial highlighted in this report involves patients with progressive meningioma and is entitled:

- Phase II trial of SMO/AKT/NF2 inhibitors in progressive meningiomas with SMO/AKT/NF2 mutations

This clinical trial will enroll patients with residual or progressive meningiomas after surgery or radiation. Tumors must have SMO or NF2 mutations as documented by central laboratory. Patients who meet these and other eligibility criteria are candidates for one of two treatment arms:

- Arm 1: Patients with SMO-mutated meningiomas will receive 150 mg vismodegib daily until study withdrawal or progressive disease
- Arm 2: Patients with NF2-mutated meningiomas will received 750 mg GSK2256098 twice daily until study withdrawal or progressive disease

Primary objectives:

- Determine activity of a SMO inhibitor in patients with SMO-mutated meningiomas as measured by 6-month PFS and radiographic response rate
- Determine activity of a FAK inhibitor in patients with NF2-mutated meningiomas as measured by 6-month PFS and radiographic response rate

Secondary objectives:

- Determine overall survival and PFS of patients in both arms
- Determine rates of adverse events in both arms

This trial is open at 173 centers in the U.S. and Canada. The PI is Priscilla Brastianos, MD, at MGH. Further information regarding this clinical trial can be obtained from allianceforclinicaltrialsinoncology.org or clinicaltrials.gov. A list of ongoing trials sponsored by the Alliance, current as of August 2016, is attached.

The spring Alliance for Clinical Trials in Oncology meeting is in November 2016, in Chicago. For details regarding the meeting, please contact me or Ian Parney, MD, PhD, FAANS.

J. Bradley Elder, MD, FAANS
Liaison to Alliance for Clinical Trials in Oncology

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Neuro-Oncology

LEGEND

Study Status: **P** = Pre-Activated **A** = Active **S** = Suspended

CTSU Section: **P** = Pending **X** = Not on menu **A** = Alliance **C** = CALGB **N** = NCCTG **Z** = ACOSOG

OPEN Registration System: **Y** = Available **P** = Pending **X** = Not in system

Protocol Number	Study Title	Study Status	Phase	CTSU Section	OPEN
Alliance A071101	A phase II randomized trial comparing the efficacy of heat shock protein--peptide complex- 96 (HSPPC-96) (NSC #725085, Alliance IND# 15380) vaccine given with bevacizumab versus bevacizumab alone in the treatment of surgically resectable recurrent glioblastoma multiforme (GBM)	A	II	A	Y
Alliance A071102	A phase II/III randomized trial of veliparib or placebo in combination with adjuvant temozolomide in newly diagnosed glioblastoma with MGMT promoter hypermethylation	A	II/III	A	Y
Alliance A071401	Phase II trial of SMO/AKT/NF2 inhibitors in progressive meningiomas with SMO/AKT/NF2 mutations	A	II	A	Y
NCCTG N0577	Phase III intergroup study of temozolomide alone versus radiotherapy with concomitant and adjuvant temozolomide for patients with 1p/19q codeleted anaplastic glioma	A	III	N	Y

Journal of Neuro-Oncology Report — Fall 2016

Linda M. Liau, MD, PhD, FAANS, Editor-in-Chief, Journal of Neuro-Oncology

The *Journal of Neuro-Oncology (JNO)* publishes 15 issues a year (including 12 regular and three special issues), with a current impact factor of 2.754 for 2015. The *Journal of Neuro-Oncology* is now published by Springer-Nature, which is one of the world's largest global research, educational and professional publishers. The change in publisher resulted from the May 2015 merger of *Springer Science Media* and *Nature Publishing Group*.

Springer-Nature will continue to provide two annual awards in the amount of $500 each to be paid directly to the corresponding author(s) selected for the *JNO* abstract award at the AANS Annual Scientific Meeting and CNS annual meeting.

For the 2016 Tumor Section Satellite Symposium, the *JNO* will be publishing the accepted abstracts in an upcoming issue. Chetan Bettegowda, MD, and Brian Nahed, MD, will be selecting and editing the abstracts for publication.

Three special issues of the *JNO* were published or will be published in 2015-2016:

- *Brain Tumor Immunotherapy* (Guest Editors: Michael Lim, MD, FAANS; and Linda M. Liau, MD, PhD, FAANS)
- *Guidelines for Low-Grade Gliomas* (Guest Editor: Jeffrey J. Olson, MD, FAANS)
- *Operative Neurosurgical Oncology* (Guest Editors: Aaron Cohen-Gadol, MD, FAANS; and Michael McDermott, MD, FAANS)

We would like to thank our associate editors for their outstanding contributions to the *JNO* over the past years:

- Eric Bouffet, MD, University of Toronto, is now the new associate editor for pediatric neuro-oncology for *JNO*
- Jeffrey Bruce, MD, FAANS, Columbia University, is the associate editor for surgical neuro-oncology
- Webster Cavenee, PhD, Ludwig Institute & UCSD, continues as an associate editor for basic science papers
- Jeffrey Raizer, MD, Northwestern University, will be stepping down as the associate editor to medical neuro-oncology at the end of 2016. We are currently looking for a replacement for Dr. Raizer and welcome nominations for medical oncologists who could take over the role as associate editor for medical neuro-oncology. *Please send nominations of qualified medical neuro-oncology applicants to Dr. Liau at (LLIAU@mednet.ucla.edu)*

The *JNO* had a total of 253,687 full-text article downloads in 2015, which is up from 251,657 in 2014. Of the downloaded articles, 24 percent were from the current year (2015), while 72 percent were contemporary articles (1997-2014). Only 4 percent of articles prior to 1997 were downloaded, so these have been archived.

As part of the new merger, Springer-Nature is working to assist all authors in disseminating their research swiftly and legally to the wider community and is now providing authors publishing in the *JNO* with the ability to generate a unique shareable link that will allow anyone to read a view-only version of the published article free of charge. Authors can now share their articles via the content sharing scheme, providing a seamless experience for users as they read open access and non-open access articles. The *JNO* will be encouraging all authors to forward links of their published articles to their co-authors, colleagues and peers, as sharing their paper is a great way to improve the visibility and impact of their work. Where it is possible to communicate with authors at the point of acceptance, acceptance letters will be edited accordingly. This content sharing campaign will hopefully encourage a greater number of citations for articles published in *JNO.*

These are the top-ranking, highest cited articles that contributed to the Impact Factor for IF Year 2015. The impact factor for 2015 is calculated from articles published in 2013-14. Our goal is to be more selective and publish fewer articles but try to generate more citations per article. Publishing more articles that generate no citations will influence the Impact Factor adversely.

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Title	Author	Publication Type	Publication Date	DOI	Volume	Issue	Total Citations*	Citations for IF 2015
Biogenesis of extracellular vesicles (EV): exosomes, microvesicles, retrovirus-like vesicles, and apoptotic bodies	Akers, Johnny C.; Gonda, David; Kim, Ryan; Carter, Bob S.; Chen, Clark C.	Review	MAY 2013	10.1007/s11060-013-1084-8	113	1	88	35
Stereotactic laser induced thermotherapy (LITT): a novel treatment for brain lesions regrowing after radiosurgery	Torres-Reveron, Juan; Tomasiewicz, Hilarie C.; Shetty, Anil; Amankulor, Nduka M.; Chiang, Veronica L.	Article	JUL 2013	10.1007/s11060-013-1142-2	113	3	29	16
Oncogenic effects of miR-10b in glioblastoma stem cells	Guessous, Fadila; Alvarado-Velez, Melissa; Marcinkiewicz, Lukasz; Zhang, Ying; et al.	Article	APR 2013	10.1007/s11060-013-1047-0	112	2	44	15
Interlaboratory comparison of IDH mutation detection	van den Bent, Martin J.; Hartmann, C.; Preusser, Matthias; Stroebel, Thomas; et al.	Article	APR 2013	10.1007/s11060-013-1056-z	112	2	29	15
Efficacy and safety of ipilimumab in patients with advanced melanoma and brain metastases	Queirolo, Paola; Spagnolo, Francesco; Ascierto, Paolo Antonio; et al.	Article	MAY 2014	10.1007/s11060-014-1400-y	118	1	19	15

Title	Author	Publication Type	Publication Date	DOI	Volume	Issue	Total Citations*	Citations for IF 2015
MiR-21 expression in the tumor cell compartment holds unfavorable prognostic value in gliomas	Hermansen, Simon Kjaer; Dahlrot, Rikke Hedegaard; Nielsen, Boye Schnack; Hansen, Steinbjorn; Kristensen, Bjarne Winther	Article	JAN 2013	10.1007/s11060-012-0992-3	111	1	38	13
Continuous daily sunitinib for recurrent glioblastoma	Kreisl, Teri Nguyen; Smith, Perry; Sul, Joohee; Salgado, Carlos; Iwamoto, Fabio M.; Shih, Joanna H.; Fine, Howard A.	Article	JAN 2013	10.1007/s11060-012-0988-z	111	1	31	13
Heparin blocks transfer of extracellular vesicles between donor and recipient cells	Atai, Nadia A.; Balaj, Leonora; van Veen, Henk; Breakefield, Xandra O.; Jarzyna, Peter A.; Van Noorden, Cornelis J. F.; Skog, Johan; Maguire, Casey A.	Article	DEC 2013	10.1007/s11060-013-1235-y	115	3	29	13
Targeting metabolism with a ketogenic diet during the treatment of glioblastoma multiforme	Champ, Colin E.; Palmer, Joshua D.; Volek, Jeff S.; Werner-Wasik, Maria; Andrews, David W.; Evans, James J.; Glass, Jon; Kim, Lyndon; Shi, Wenyin	Article	MAR 2014	10.1007/s11060-014-1362-0	117	1	19	13
MEG3: a novel long noncoding potentially tumour-suppressing RNA in meningiomas	Balik, Vladimir; Srovnal, Josef; Sulla, Igor; Kalita, Ondrej; Foltanova, Tatiana; Vaverka, Miroslav; Hrabalek, Lumir; Hajduch, Marian	Review	MAR 2013	10.1007/s11060-012-1038-6	112	1	36	12

International Report Summary

Submitted by Ricardo Komotar, MD, FAANS

The International Committee has had a successful year. Below is a brief summary of a few notable societies:

The World Federation of Neurological Societies (WFNS) has increased tumor section member contribution to WFNS neuro-oncology committee courses. Their goal is to have a robust internationally recognized representation, including medical oncology, radiation oncology and neuropathology subspecialists. The primary mission for this committee is dissemination of academic neuro-oncology internationally. To achieve this, the WFNS is focused on offering educational/academic courses at host institutions around the world (two to three annual neuro-oncology educational sessions internationally) and partnering with local neurosurgery societies of the hosting country. To date, since 2013, the WFNS has held courses in India, Philippines, Australia, Italy, Malaysia, Chile and Turkey. The WFNS has also hosted lunch sessions at SNO for the past two years. There are two joint Tumor Section and WFNS courses planned for 2017.

The European Association of Neurosurgical Societies (EANS) tumor section has grown to more than 200 members. They have a new recently appointed chair, Colin Watts, PhD, who has taken over for Prof. Zvi Ram. Future goals include integrating the AANS/CNS Tumor Section in EANS training courses by providing expert opinion and informed speakers. The EANS tumor section also wishes to promote collaborative surgical trials in neuro-oncology. More specifically, Switzerland has developed two collaborative multicenter clinical trials. First, a phase I PIQUR-study for patients with recurrent glioblastoma. PIQUR evaluates a PI3K/mTOR-inhibitor (PQR309) with blood-brain-barrier penetrating properties. Second, a phase II clinical trial looking at peptide receptor radionuclide therapy (PRRT) with radiolabelled DOTA-OPS201 for progressive or recurrent meningiomas.

The Indian Society of Neuro-oncology (ISNO) has expanded their annual meetings this year in collaboration with the Asian society of Neuro-oncology in Mumbai. The goal is to have AANS/CNS Tumor Section members participate in the ISNO live surgery workshop and a brain tumor symposium in Winter 2017.

Special thanks to Dominik Cordier, MD; Atul Goel, MD, IFAANS; Gelareh Zadeh, MD, PhD; and Dr. Watts for all their hard work on this committee.

Stereotactic Radiosurgery Reports: Fall 2016

Jason Sheehan, MD, PhD, FAANS, Email: jsheehan@virginia.edu

The Leksell Gamma Knife Society held its biennial meeting in Amsterdam. The international meeting was held May 15-19, 2016. The theme of the meeting was "Building Bridges…." Meeting attendance was high. The topics covered include radiosurgery for functional, vascular and tumor targets. Other focuses include quality outcomes and international registries. Proceedings from the meeting will be published in a special supplement to the *Journal of Neurosurgery (JNS)* in December 2016.

The International Gamma Knife Research Foundation (IGKFR) has launched a number of new trials in radiosurgery many of which are tumor related. Study site participation is still needed. Prospective and retrospective trials for the IGKRF can be found at http://www.igkrf.org/projects.html. Also, the IGKRF is planning a meeting to be held at the University of Pennsylvania from June 23-24, 2017. John Lee, MD, FAANS from the department of neurosurgery at the University of Pennsylvania is the local host.

The International Society of Stereotactic Radiosurgery is hosting its biennial meeting in Montreaux, Switzerland, from May 28-June 1, 2017. More details can be found at the following link: http://www.isrscongress.org/en/.

The national Stereotactic Radiosurgery (SRS) Registry, under the auspices of the AANS and the American Society for Radiation Oncology (ASTRO), has demonstrated exponential patient accrual. Patient accrual is occurring at sites including University of Cincinnati; New York University; University of Virginia; University of Colorado; Carolina Medical Center; William Beaumont; Norton Cancer Institute; Thomas Jefferson University; Vanderbilt University Medical Center; and University of Southern California. More than a dozen additional sites are set to come online in the next couple of months. Initial data analysis will be performed by the Quintiles biostatisticians this summer. A PI meeting for the SRS Registry was held at the 2016 AANS Annual Scientific Meeting in Chicago.

SRS Registry patient accrual as of May 31, 2016, is depicted by the graph below.

Society of Neuro-Oncology Meeting Update

Gelareh Zadeh, MD, PhD

This year, the 21st Society of Neuro-Oncology (SNO) Scientific Meeting was held in Phoenix, Nov. 17-20, 2016. The theme of the Education Day and Scientific Meeting was focused on Molecular Pathology, timed with the release of the new World Health Organization (WHO) Neuro-pathology update and keen interest from the community on integrating molecular information into brain tumor classifications. There were two exciting pre-conference sessions: one is dedicated to CNS Anticancer Drug Discovery and Development and the second is a very popular Neuro-oncology Review Course primarily attended by neuro-oncologists but is also pertinent for trainees and fellows from neurosurgery interested in the field.

Keynote speakers for Friday of the main meeting included David Louis, MD, and David Ellison, MD, PhD, centered on 2016 WHO Classification Updates in Pediatric and Adult Brain Tumors. On Saturday, two keynote speakers focused on Epigenetics of Gliomas: Joseph Costello and Bradley Bernstein. Notable awards included the Victor Levin Award going to David Louis, MD, who is also an invited keynote speaker. The Lifetime Achievement Award went to Mary Lovely, RN, PhD, and the Guha Award to Michael Taylor, MD, PhD. A new award was introduced this year in memory of Andrew T. Parsa. MD, PhD, FAANS. The Andrew Parsa Young Investigator-Basic/Translational Science was awarded to Daniel Orringer, MD.

The main meeting followed the new format introduced in 2014, with increased number of sunrise session, introduction of lunch sessions, increased number of concurrent sessions. It also included rapid reports, which has been a well-received short report of abstract presentation with associated discussion period, e-Talks and meet-the-expert videos. Improved technological aspects of the meeting include integrated touch-screen presentation, webcasts for SNO highlights and texting of questions to speakers. These are all features which engaged the audience and participants at this well-attended meeting.

Skull Base Tumor Update

Michael J. Link, MD, Mayo Clinic, Rochester, Minn.; Daniel Prevedello, MD, The Ohio State University; Wexner Medical Center, Columbus, Ohio

It has been an extremely busy and exciting summer regarding skull base surgery. Multiple international meetings were held that were very productive and informative. The 7th World Congress for Endoscopic Surgery of the Skull Base and Brain (Endo Chicago) was held May 15-18, 2016, in Chicago. Thanks to the generous contributions of more than 230 faculty members coming from 42 countries, the meeting offered a stimulating and action-packed program that attracted more than 700 participants from 64 countries.

The meeting started with eight keynote lectures that set the collegial and high standard for the Congress, covering a wide range of topics ranging in scope from history of endoscopy and skull base surgery, to advances in imaging, integration of technologies in the operating room, robotics and value based oncologic treatment. This was followed by a four-day program with 112 exhilarating round table discussions comprising over 400 oral presentations, more than 200 scientific posters and oral presentations and a selection of lunch and breakfast symposia. Thanks to multiple corporate partners, new technologies and surgical devices were prominently displayed. Controversies in endoscopic skull base surgery were prominently highlighted with spirited debates by leaders in the field.

Also, May 15-18, the Biennial 18th Leksell Gamma Knife Society Meeting was held in Amsterdam, Netherlands. This meeting also featured multiple panels and debates regarding the role of observation, radiosurgery, fractionated radiotherapy and surgery for a variety of skull base tumors. There were 126 oral presentations accepted from submitted abstracts and 228 e-posters. A very international contingent of experts in the application of stereotactic radiosurgery for the treatment of skull base disorders debated the merits and expected results with the backdrop of a wonderful, cosmopolitan European destination. Many of the panel debates can be viewed by visiting the website at www.lgksociety.com. The next meeting will be March 4-8, 2018, in Dubai, UAE.

Similarly, the Biennial 12th Congress of the European Skull Base Society (ESBS) meeting was held May 26-28, in Berlin, Germany. Robert Behr, MD, from Fulda, was the presiding president. Almost 420 people from 45 nations were present. Notably, Croatia and Turkey officially became new members of the ESBS and received their official certificate at the Gala Event at the Arminius-Markthalle. The stimulating program included early morning debates and key note lectures covering essentially all topics of skull base pathology during over 100 sessions, including 415 presentations. The inaugural Wolfgang Draf Memorial Lecture was delivered by Madjid Samii, MD, PhD, from Hannover, Germany, who had the distinct opportunity to have worked with Professor Draf earlier in his career. The next meeting of the ESBS is scheduled for 2018 in Warsaw, Poland. Kazimiers Niemczyk, MD, from Warsaw, will be the presiding president. You can keep appraised of the planning at www.esbs.eu.

Then, June 14-17, the quadrennial World Skull Base Congress (WFSB) was held in Osaka, Japan, in conjunction with the 28th Annual Meeting of the Japanese Society for Skull Base Surgery and the 10th Congress of International Meningioma Society and Cerebral Venous System. This meeting brings together all the skull base societies for an opportunity for collaboration and ideas sharing every four years. Kenji Ohata, MD, DMSc, IFAANS, organized a truly international program featuring experts and thought leaders from around the globe. Michael Gleeson, MD, of London, England, completed his four-year term as president and Basant Misra, MD, of Mumbai, India, was elected the new president. Abstracts can be viewed at http://www.skullbase2016.jp/. The next meeting of the WFSB will be in the Spring 2020 in Rio de Janeiro, Brazil.

Most prominently, the 27th annual scientific meeting of the North American Skull Base Society (NASBS) is well into the final planning stages. This meeting will be held in exciting New Orleans, March 1-5, 2017, at the Roosevelt Waldorf-Astoria Hotel, within walking distance to the Historic French Quarter. The abstract submission site is currently open accepting abstracts regarding the diagnosis and management of all aspects of skull base disorders. Jacques J. Morcos, MD, FAANS, (University of Miami) is this year's president and has an exciting and innovative agenda planned with breakfast sessions, consensus meetings and Pecha Kucha sessions. The theme of the meeting is: "Mastery and Legacy in Skull Base Surgery: Lessons in Synchronicity." The "Mastery" component will reflect the three phases of Creativity (Innovation), Experience (Surgical expertise) and Scrutiny (Evidence-based analysis). The "Legacy" component will celebrate the crucial gift of scientific perpetuity through the contributions of the giants of our field. Notably, there will be a celebration of the life and work of Albert L. Rhoton Jr., MD, FAANS(L), who passed away earlier this year. There will be a two-day, pre-meeting practical course at the state-of-the-art, anatomical dissection laboratory on the campus of Louisiana State University (LSU). This provides a wonderful opportunity for residents, fellows and practicing neurosurgeons to refine and learn new techniques from the true innovators in the field.

AANS/CNS Section on Tumors - Young Neurosurgeons Reception

Walavan Sivakumar, MD; and Ian Dunn, MD, FAANS

AANS Annual Meeting
May 3, 2016

CHICAGO, IL - William T. Couldwell, MD, PhD, FAANS, chair of the Department of Neurosurgery at the University of Utah and former president of the AANS, was the honored guest at the AANS/CNS Section on Tumors Young Neurosurgeons Reception, co-hosted by the Young Neurosurgeons Committee (YNC), at the AANS Annual Scientific Meeting on May 3, 2016.

An internationally renowned skull base/cerebrovascular surgeon and mentor to numerous leaders within organized neurosurgery, he spoke candidly to a captivated audience of nearly 60 young neurosurgeons and leaders of the tumor section about lessons learned along his path to becoming a mentor. Using the life of William Osler, a Canadian-born physician, as the framework for his talk, he gave several recommendations that resonated in different ways for the members in the audience, from the youngest medical students attending their first scientific meeting to the most senior faculty, reflecting on their own path towards becoming a mentor. Osler was the mentor of Harvey Cushing and is credited with developing the residency model for specialty training.

Benjamin Franklin's quote "Tell me and I forget, teach me and I may remember, involve me and I learn," guided Dr. Couldwell's discussion about the importance of mentorship. He cited a survey of millennials in which they indicated that the number one thing they desired was mentorship and guidance, but he noted that, while it is universally desired, the ability to teach and guide is not innate. Neurosurgical mentorship is a learned skill that is developed and must be honed from the first day of internship. Just as the intern seeks guidance and tutelage from the chief residents and faculty, they serve as the primary purveyors of knowledge to the medical students first contemplating entering the field of neurosurgery.

Dr. Couldwell cautioned young neurosurgeons of what he called the "Dilbert dilemma of academia," named after the comic strip about business and workplaces. Near the end of training and early in practice, especially with the increased priority on generating clinical revenue, he noted that the tendency is to sway one's focus too far towards clinical activity. This, worsened by the difficulties in attaining and maintaining scientific funding, often comes at the cost of academic productivity. He recounted the importance of his primary mentors, Martin Weiss, MD, FAANS(L), and William Feindel, MD, FAANS(L), in maintaining his focus on the totality of neurosurgery.

As he advanced through his career, Dr. Couldwell also appreciated the importance of humility and character in developing oneself into a leader. The primary objective of the neurosurgical leader should be to become a leader at home (in one's department or hospital), which requires garnering the respect of one's colleagues. The three pillars of excellence—availability, affability and ability—aptly illustrate the necessary components of not only the successful clinician, but the rising leader. He cautioned burgeoning leaders as they progress through the ranks against the pitfall that "organized neurosurgery is not all neurosurgery." The primary focus of all neurosurgeons should always be the patient.

Touching on the intriguing duality of the mentor/mentee relationship, Dr. Couldwell recounted the tale of Cushing providing the anesthesia for Revere Osler after he was shot in the chest during the First World War in Belgium. Cushing later went on to write the biography of his mentor and his patient's next of kin, William Osler, which was awarded the Pulitzer Prize.

The AANS/CNS Section on Tumors and the YNC are pleased to announce that the honored guest for the Young Neurosurgeons Reception at the 2016 CNS Annual Meeting was former president of the AANS and CNS and world renowned surgical neuro-oncologist, Dr. Edward R. Laws Jr., MD, FAANS(L).

Washington Committee Report

by Katie Orrico, JD; Submitted respectfully by Brian Nahed, MD

The AANS/CNS Washington Committee met on July 15, 2016. The meeting covered a broad array of issues important to neurosurgeons. Highlighted below are several key discussion topics.

CMS Proposes Major Overhaul of Medicare Physician Payment System

A major portion of the meeting focused on the implementation of the new Medicare physician payment system, the Medicare Access and CHIP Reauthorization Act, or MACRA, which Congress enacted last year to replace the flawed sustainable growth rate (SGR) system with a new payment system. Earlier this year, on April 27, 2016, the Centers for Medicare & Medicaid Services (CMS) issued a proposal to implement key elements of MACRA. Through a single framework called the "Quality Payment Program," the new payment paradigm has two paths: the Merit-based Incentive Payment System (MIPS) and the Advanced Alternative Payment Models (APMs). The new program consolidates components of three existing Medicare penalty programs: Physician Quality Reporting System (PQRS), Electronic Health Record (EHR) and Value-Based Payment Modifier (VM) and creates an opportunity for neurosurgeons to earn quality improvement bonus payments.

Initially, most neurosurgeons will likely participate in the Quality Payment Program through MIPS, which will allocate payments based on performance in four categories: quality, Advancing Care Information (formerly EHR meaningful use), clinical practice improvement activities and cost/resource use. CMS would begin measuring performance of physicians through MIPS in 2017, with payments based on those measures starting in 2019. Neurosurgeons participating to a sufficient extent in risk-based APMs would be exempt from MIPS reporting requirements and qualify for financial bonuses in addition to any shared savings earned through the APMs.

The AANS and CNS have some significant concerns about the new payment system as proposed by CMS, and the Washington Committee and Washington Office staff continue to meet with senior leaders at CMS, members of Congress and other stakeholders to help ensure that the final rules allow neurosurgeons to successfully participate in the Quality Payment Program. In the coming weeks and months, the Washington Committee will be publishing a variety of educational materials to ensure that neurosurgeons are "MACRA ready" and can thrive under the new quality payment program.

CMS Proposes New Onerous Global Surgery Data Collection Mandate

Just prior to the meeting, CMS announced a sweeping global surgery services data collection mandate. According to the proposal, beginning on Jan. 1, 2017, neurosurgeons providing 10- and 90-day global surgery services to Medicare patients will be required to document and report on the type, level and number of pre- and postoperative visits furnished during the global period for every global surgery procedure. Under this system, neurosurgeons would be required to use a new set of G-codes to report on each 10-minute increment of services provided. This proposal completely ignores MACRA, which requires CMS to collect data from a "representative sample" for the purpose of evaluating the accuracy of global surgery code values. The Washington Committee has launched an aggressive advocacy campaign to prevent the agency from moving forward with this burdensome data collection proposal.

And the Rest…

Other topics discussed by the committee, included:

- The AANS/CNS Neurosurgery Quality Council's (NQC) is tracking Medicare's bundled payment programs, including the Comprehensive Joint Replacement bundled payment program. It is likely that CMS will target neurosurgical procedures, particularly spine and stroke, for future payment bundles. Along these lines, the NQC is collaborating with the American College of Surgeons (ACS) and Brandeis to develop surgical bundles for a surgical alternative payment model.
- The Washington Committee is working on a number of issues related to neurosurgical education and training, including pending legislation to increase the number of Medicare supported GME residency slots, efforts to encourage the Accreditation Council on Graduate Medical Education (ACGME) to establish more flexible duty hours rules and nominations pending before the ACGME for the Neurosurgery RRC and the ACGME Board. In addition, the One Neurosurgery Summit group, which includes the AANS, American Board of Neurological Surgery (ABNS), CNS, Society of Neurological Surgeons (SNS) and Washington Committee, have developed a position statement on concurrent and overlapping surgery.
- The AANS/CNS Drugs and Devices committee has been working closely with the Food and Drug Administration (FDA) on a number of initiatives to ensure that lifesaving neurosurgical technologies come to market in a timely fashion. The committee is also working to ensure that the Open Payments program, which tracks industry payments to physicians, is user-friendly and incorporates accurate information. Other priority topics include off-label use, the 21st Century Cures/Innovation legislation currently pending before Congress and organized neurosurgery's participation on the AMA's opioid task force, including passage of the Comprehensive Addiction and Recovery Act.
- The AANS/CNS Communications and Public Relations (CPR) Committee has been very busy growing the Neurosurgery Blog, Twitter and Facebook followers. The CPR launched a very successful effort, spotlighting the month of March as GME month. In September, the CPR highlighted the issue of concussions, given that it is back to school and the start of sport leagues' fall seasons. The AANS/CNS Washington Office's social media presence far outstrips larger groups such as the ACS and the American Association of Orthopaedic Surgeons (AAOS), which are five to 10 times larger than the AANS and CNS. Tumor Section members are encouraged to connect with the Washington Committee on its various social media platforms, which will allow you to keep up with the many health-policy activities happening in the nation's capital and beyond the Beltway.

Guidelines Update

Jeffrey J. Olson, MD, FAANS; and Brian V. Nahed, MD

The guidelines effort of the Joint Tumor Section is alive and well. With the maturation of previous guidelines, there is a significant effort now being put toward updating them. The newly diagnosed glioblastoma guidelines are underway. Additionally, the metastatic brain tumor guidelines have also begun this year and were highlighted at the CNS 2016. Even though just a few years have elapsed since the original publications, literally thousands of new publications pertinent to these topics have appeared that are being reviewed to determine which can provide improvements and upgrades to the original guidelines statements.

New guidelines topics are in various degrees of development, writing and publication. The guideline for the management of nonfunctioning pituitary adenomas, led by Manish Aghi, MD, PhD, FAANS, has secured Joint Guidelines Committee approval and is now in preparation for publication in *Neurosurgery*. The nine-section guideline on management of vestibular schwannomas has nearly completed writing of all sections and will then be submitted to the Joint Guidelines Committee for review. The guidelines for management of metastatic spinal tumors led by Timothy Ryken, MD, FAANS, will tentatively be published in two sections to facilitate it reaching print more efficiently. This is a topic with substantial overlap with the interests and expertise of the Joint Section on Spine, and this group is currently being tapped to facilitate the writing.

The members of the Joint Tumor Section have provided a number of proposals for additional guidelines to be written. This includes development of documents regarding the management of chordomas, functioning/hormonally active pituitary adenomas, medulloblastomas and PNET's and CNS lymphomas. These and other topics will come online over time as time and manpower allow.

Though sometimes controversial, the guidelines effort is of real value to our specialty and can be used for teaching, setting benchmarks for future clinical and basic research development, justification for billing patterns for CMS and insurance companies and other relatively diverse topics. Reflective of this perceived value, the CNS has provided support for the guidelines effort in the form of support staff in the CNS central office. Trish Rehring and Mary Bodach provide organizational, reference librarian and proofreading expertise to the writing groups to facilitate this important effort for our specialty. This resource and the small group of productive writers in our section are the key the progress of our guidelines effort.

New Multicenter 5-ALA Trial for Malignant Gliomas

In June 2016, a new investigator-initiated trial entitled "A Multicenter Study of 5-Aminolevulinic Acid (5-ALA) to Enhance Visualization of Malignant Tumor in Patients with Newly Diagnosed or Recurrent Malignant Gliomas: A Safety, Histopathology, and Correlative Biomarker Study" began enrolling patients in the Mount Sinai Health in New York. This will be the first multicenter study utilizing 5-ALA (Gliolan®) in the U.S. for malignant glioma patients. The study is sponsored by Costas G. Hadjipanayis, MD, PhD, FAANS, professor and director of Neurosurgical Oncology at Mount Sinai. Isabelle Germano, MD, FAANS, rofessor of Neurosurgery at Mount Sinai, will serve as the principal investigator. Approximately 20 centers will take part in this multicenter study that will include 100 new or recurrent malignant glioma patients. A correlative serum biomarker study, led by the University of California San Diego (UCSD), will be included for centers participating. The multicenter trial will evaluate the utility of Gliolan® (5-ALA), and its metabolite protoporphyrin IX (PPIX), as an intraoperative fluorescent detection agent for the visualization of malignant tumor during the resection of malignant gliomas. The safety of oral Gliolan® and the utility/functionality of the operative microscope fitted with a fluorescence-light observation accessory for visualization of tumor fluorescence will also be assessed. Please reach out to Dr. Hadjipanayis (Constantinos.Hadjipanayis@mountsinai.org) or Yitzchak David, RN, MPH, (Yitzchak.David@mountsinai.org) with any questions.

The Role of Laser Ablation in the Management of Gliomas

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Magnetic resonance-guided laser-induced thermotherapy (MR-LITT) is a minimally invasive tool in the armamentarium of surgical options for patients with glioma. The concept of laser ablation, which extends from earlier studies of thermal ablation with radiofrequency probes, is that a thermal energy source can produce coagulative necrosis of tumor tissue under image feedback-control conditions (1). This would in effect result in cytoreduction without the need for open surgery. With the advent of MRI thermography and near-infrared laser light delivery source tuned for maximal tissue penetration, greater control of thermal heating of a target in the brain has been made possible. MR-LITT has been used for the ablation of multiple extra-cranial solid tumors, including breast and liver (2-5). More recently, its use has been reported in patients with primary and metastatic intra-cranial tumors (6-10) and epileptic lesions (11-15). In this review, we focus on the current use of MR-LITT in glioma surgery with the goal of outlining its indications.

The procedure of MR-LITT involves stereotactic placement of a delivery catheter that serves as a sheath for the placement of a fiber optic laser source within a central axis along the tumor. The typical maximal dimensions of the target lesion are restricted in a plane perpendicular to the catheter trajectory to within 15 mm on either side, but the length of the possible cylinder is not limiting due to the ability to retract the laser fiber along the delivery catheter. The theoretical volume can be calculated from the formula Pi * 1.5 cm^2 * length, so that the maximal tumor volume that can be ablated is

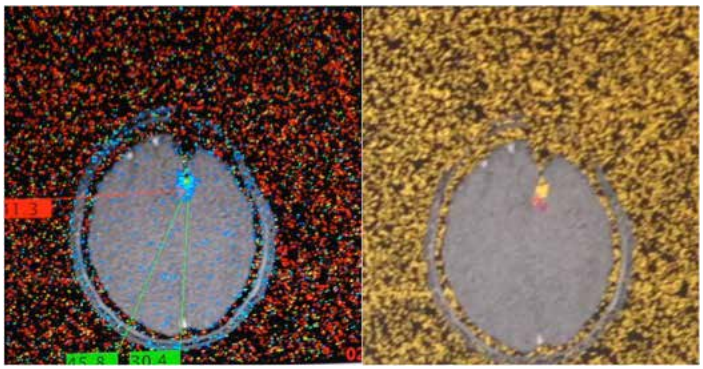

Figure 1: Recurrent left frontal glioblastoma treated with MR-LITT. Left panel shows the temperature map during cooling after completion of ablation (color scale: red hot to blue cold). Right panel shows the tissue damage estimate (yellow) generated by the computer software calculations using time and temperature.

a function of the catheter length and number of guidance catheters used. After placement of the laser catheter, the remainder of the procedure is conducted in the MRI room. T1 images are used to ascertain the two planes orthogonal to the catheter trajectory. Then, reference images are obtained in a standard sequence that allows visualization of the tumor margins (T1W with Gadolinium for enhancing tumors or T2W for non-enhancing tumors). Spoiled gradient images are used to calculate the temperature-dependent phase shift that occurs during the operation of the laser source (7). Commercially available systems in the U.S. offer either 980 nm diode laser (Visualase, Medtronic Inc.) or a 1064 nm Nd:YAG laser (NeuroBlate, Monteris Medical, Inc.) light, which is converted to thermal energy by tissue absorption (6,16). Tissue heating is dependent on the absorption and scattering properties, which vary with tissue type (17). Glioblastomas show higher absorption than normal grey and white matter, while low-grade gliomas show absorption similar to normal grey matter and less than white matter (18). Since the majority of laser light energy is absorbed within ~1.2 cm, the distribution of tissue damage at the margins of the ablation volume is dependent on thermal conductivity and convection and has been shown to be strongly dependent on the tissue perfusion rate (19). Real-time tissue damage estimates can be generated from temperature –time graphs at each field of view voxel in the imaging plane with a theoretical temperature spatial precision error of 2 mm (**Figure 1**) (20). Commercial software is available with the NeuroBlate system that allows pre-ablation planning of the damage estimate and automated laser power and duration adjustments to achieve tissue damage targets established by the surgeon. One of the important advantages of the image feedback used during ablation is the ability to establish a temperature dependent safety margin between the target to be ablated and adjacent eloquent cortical or subcortical structures. Since the current software systems that provide damage estimates are still in development, the surgeon must be cognizant of the fundamental physical constraints on precision and the temperature-time dependent damage that occurs in adjacent tissue. We have found in our practice that attentive monitoring of temperature changes in the adjacent brain and important eloquent structures by the surgeon at the time of ablation is key to ensuring a safe ablation.

The two major advantages of MR-LITT in the surgical management of gliomas are first the ability to achieve cytoreduction in deep-seated tumors for which open surgery is not possible or carries with it a high risk of complication, and secondly, the avoidance of a craniotomy in patients who have or will receive radiation and cytotoxic chemotherapy. Other advantages of MR-LITT resulting from the disruption of adjacent blood-brain barrier facilitating enhanced delivery of circulating agents (21) are under investigation. Since the laser catheter is delivered through a 4 mm

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incision, producing minimal tissue disruption and requiring only a single suture for closure, adjuvant radiation and chemotherapy, can be started early after the procedure (in our experience after one week). MRI-LITT avoids the re-opening of a prior craniotomy with avoidance of the inherent risks of wound dehiscence, CSF leak and infection. Re-opening of the prior dural closure is not required. Therefore, damage to cerebral cortex adherent to the dura at the prior durotomy site is avoided, rendering a safety advantage to the use of MR-LITT for recurrent glioma surgery. The risk of re-operative craniotomy for gliomas is substantial as evidenced by the Glioma Outcome Project, which reported a 33 percent rate of perioperative complication and 18 percent rate of worsened neurological status after surgery (22). While the number of patients with recurrent glioma treated to date by MR-LITT is not sufficient to make definitive conclusions about its superiority to open-surgery, the safety profile in reported cases has been favorable (**Table 1**) (7,9,10,23-27). The life-threatening procedure-related complication of malignant edema has only been reported for a large glioblastomas (60 cm^3) (24). Therefore, tumors of sufficient volume to require multiple catheters are at significant risk of procedural complication and are not be considered candidates for MR-LITT in our practice. It is important to note that the most common complications have been temporary or permanent new neurologic deficit, as such, careful planning and execution of the thermal ablation is required in order to improve postoperative outcomes. The surgeon should always consider the potential injury to adjacent eloquent cortical and subcortical areas and closely monitor the temperature rise in these areas to avoid permanent injury during ablation. Avoiding new neurological deficit is important in order to benefit from the minimally invasive nature of the procedure, which shortens both intensive care unit and hospital length of stay (7,24).

Growing evidence for a survival advantage for use of MR-LITT in recurrent glioblastoma is emerging as MR-LITT technology is adapted at multiple centers across the U.S. and Canada. As with any new surgical technology appropriately controlled trials are required and given the enthusiasm for reducing surgical complications and neurological morbidity in patients with recurrent glioblastoma, such trials are expected in the future. At present comparison of duration of survival after treatment with MR-LITT has been made to historical controls in reported case series involving variability in tumor size, timing of initiation of therapy, prior treatments and adjuvant therapy after MR-LITT treatment. Therefore, conclusions of the effectiveness of MR-LITT in recurrent glioblastoma compared to open resection are not possible at this time. Again, the outcomes have been favorable in comparison to historical controls, but the effect of confounding factors is unmeasured (**Table 2**) (7,9,10,25,26). A close analysis of the risks and benefits of using MR-LITT versus open surgery for those tumors that are surgically accessible is warranted. This is particularly important considering the survival benefit recently reported for open re-operation in patients with GBM compared to medical management (28).

MR-LITT is becoming a treatment option in glioma patients with high open surgical risk and tumors with location and configuration amenable to this ablative modality. While the excitement behind this now readily available technology is growing, it must be tempered by careful consideration of the scientific evidence available for its indication, safety and effectiveness. In the coming years, we envision defined criteria for its use and prospective randomized or case-controlled data defining treatment outcomes of MR-LITT in comparison to open surgery. Defining the outcomes of chemotherapy options alone versus in combination with MR-LITT for newly diagnosed or recurrent gliomas not amenable to open surgery will also be important. The development of MR-LITT technology harkens back to the early days of clipping versus coiling. It will be a goal for the neuro-oncologic surgeons to follow suit to our cerebrovascular colleagues in collecting robust data to establish the indications and outcomes of this new intervention.

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Table 1. Postoperative complications in patients treated with MR-LITT for glioma. Case series with < 5 cases excluded.

Study	Tumor	Complication	Total Patients
Leonardi and Lumenta, 2002	LGG/GBM/AA/AO	2 Persistent deficit 1 Temporary deficit 1 Seizure 1 Wound infection 1 Brain abscess	24
Schulze et al., 2004	GBM/AA	N/R	8
Schwarzmaier et al., 2006	GBM	1 Temporary deficit	16
Hawasli, 2013	GMB/AO	1 Fatal meningitis 2 Temporary deficit 1 Temporary hyponatremia 1 DVT	11
Sloan, 2013	GBM	2 Temporary deficit 1 Persistent deficit 1 Intracerebral hemorrhage 4 DVT or PE 1 Neutropenia	10
Mohammadi, 2014	GBM/AA/AO	5 Temporary deficit 2 Persistent deficit 1 Seizure 1 Hyponatremia 2 Infection 2 DVT	35
Patel, 2016	GBM	1* Death (malignant edema)	25

LGG – low grade glioma, GBM – glioblastoma, AA – anaplastic astrocytoma, AO- anaplastic oligodendroglioma, CSF – cerebrospinal fluid, DVT – deep venous thrombosis, N/R – no intra-op complications, post-op complications not reported.

*Study only reported aggregate data for primary brain tumors treated, unable to ascertain other complications in GBM patients alone from data provided.

Table 2. Survival outcomes for patients with recurrent GBM after MR-LITT treatment.

Study	Outcome	Follow-up	Total Patients
Schwarzmaier et al., 2006	6.9 mo. median OS	9.1 mo (mean)	16
Carpentier, 2012	10 mo. median OS	15 mo*	4
Sloan, 2013	10 mo. median OS	6 mo+	10
Hawasli, 2013	8 mo. median PFS	5.2 mo (median)	11
Mohammadi, 2014	5.1 mo. median PFS	7.2 mo (median)	24

*Longest period of follow-up, all patients died at or prior to this duration. +Pre-specified follow-up period for all patients.

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