



Steven D. Chang, MD

Robert C. and Jeannette Powell Neurosciences Professor and, by courtesy, of Otolaryngology - Head & Neck Surgery (OHNS) and of Neurology Neurosurgery

 NIH Biosketch available Online

CLINICAL OFFICES

- **Stanford Neuroscience Health Center**

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- **Stanford Dept of Neurosurgery**

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ACADEMIC CONTACT INFORMATION

- **Alternate Contact**

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Bio

BIO

Dr. Chang is a Professor and Vice Chairman of Strategic Development and Innovation in the Department of Neurosurgery at Stanford. He is also the inaugural holder of the Robert C. And Jeannette Powell Professorship in the Neurosciences at Stanford University School of Medicine. His clinical work and research focuses on the treatment of brain tumors and cerebrovascular disease.

After receiving his Medical Degree and completing his Neurosurgery residency training at Stanford University, Dr. Chang joined Stanford's Department of Neurosurgery in 2000. He was named full professor in 2008, and that same year was appointed as the Powell Professor in the Neurosciences. Dr. Chang has a national and international reputation as an expert in both microsurgery and radiosurgery for treatment of brain, spine, and skull base tumors, and is the Co-Director of the Surgical Neuro-Oncology Program. His radiosurgery practice focuses on the use of the Cyberknife to treat neoplasms of the brain and spine. He was instrumental in the rapid growth of the Stanford Cyberknife Radiosurgery Program and is currently Co-Director of this program. Dr. Chang also specializes in the treatment arteriovenous malformations and cavernous malformations of the brain and spine, and surgical treatment of intracranial aneurysms. A fellowship trained cerebrovascular neurosurgeon, Dr. Chang specializes in multi-modality therapy for these vascular lesions. He is also an expert in both microsurgery and radiosurgery for treatment of trigeminal neuralgia.

Dr. Chang's research focuses on clinical outcomes for radiosurgery of brain and spine tumors. His lab has active research projects involving genetic analysis of arteriovenous malformation patients. He is the Director of the Stanford Neurogenetics Oncology Program and the Director of the Stanford Neuromolecular Innovations Program. He is the author or co-author of more than 300 peer-reviewed publications and book chapters.

CLINICAL FOCUS

- Cancer > Neuro Oncology
- Brain / Central Nervous System Tumors

- Brain / Central Nervous System Tumors - Neuro Oncology
- Brain / Central Nervous System Tumors - Neurosurgery
- Neurological Surgery
- Neurosurgery
- Skull Base Tumors
- Skull Base Tumors - Head and Neck Surgery
- Spinal Cancer
- Spinal Cancer - Neurosurgery
- Spinal Cancer - Surgery
- Acoustic Neuroma
- Glioma, Astrocytic
- Glioma
- Glioblastoma
- Glioblastoma with Sarcomatous Component
- Astrocytoma
- Ependymoma
- Medulloblastoma
- Meningioma
- Intracranial Aneurysm
- Carotid Stenosis
- Arteriovenous Malformations
- Intracranial Arteriovenous Malformations
- ACTH-Secreting Pituitary Adenoma
- Adenoma, Prolactin-Secreting, Pituitary
- Diabetes Insipidus, Pituitary
- Growth Hormone-Secreting Pituitary Adenoma
- Hypothalamic-Pituitary Neoplasms
- Neoplasms, Hypothalamic-Pituitary
- PRL-Secreting Pituitary Adenoma
- Pituitary ACTH Hypersecretion
- Pituitary ACTH-Producing Cells
- Pituitary ACTH-Secreting Cells
- Pituitary Adenoma, Prolactin-Secreting
- Pituitary Adrenocorticotropin-Secreting Cells
- Pituitary Apoplexy
- Pituitary Diseases
- Pituitary FSH Hypersecretion
- Pituitary Gland
- Pituitary Growth Hormone-Secreting Cells

- Pituitary Irradiation
- Pituitary Neoplasms
- Prolactin-Producing Pituitary Adenoma
- Prolactin-Secreting Pituitary Adenoma
- Vestibular Schwannoma
- brain metastasis
- Cyberknife
- Radiosurgery, Stereotactic
- Stereotactic Techniques
- spinal avm
- spinal tumor
- Spinal Meningioma
- spinal schwannoma
- Trigeminal Neuralgia
- Hemifacial Spasm
- Glossopharyngeal Nerve Diseases
- AVM (Arteriovenous Malformation) Intracranial
- Stroke
- Brain Tumor, Primary
- Brain Tumor, Recurrent
- Brain Tumors
- Malignant Primary Brain Tumors
- Primary Malignant Brain Tumors
- Aneurysm, Cerebral
- Acoustic Neuroma, Cerebellopontine Angle
- Aneurysm, Anterior Cerebral Artery
- Aneurysm, Middle Cerebral Artery
- Aneurysm, Posterior Cerebral Artery
- Anterior Cerebral Artery Aneurysm
- Cerebral Cavernous Hemangioma
- Cerebral Hemorrhage
- Cerebral Vasculitis
- Middle Cerebral Artery Aneurysm
- Posterior Cerebral Artery Aneurysm
- Vascular Malformations, Brain
- Brain Aneurysm
- Brain Neoplasms
- Brain Revascularization
- Neurogenetics

- Neuroproteomics
- Neurocutaneous Syndromes
- Glomus Tumor
- Craniopharyngioma
- Pituitary tumor

ACADEMIC APPOINTMENTS

- Professor - University Medical Line, Neurosurgery
- Professor - University Medical Line (By courtesy), Otolaryngology - Head & Neck Surgery Divisions
- Professor - University Medical Line (By courtesy), Neurology & Neurological Sciences
- Member, Bio-X
- Member, Cardiovascular Institute
- Member, Wu Tsai Neurosciences Institute

ADMINISTRATIVE APPOINTMENTS

- Co-Surgical Director, Pituitary Program, Stanford, (2006-2007)
- Capital Asset Management Committee, Stanford, (2005-2010)
- Topic Review Editor, Editorial Board, Neurosurgery, (2005-2010)
- Editorial Board, World Neurosurgery, (2010-2012)
- Editorial Board, Journal of Radiosurgery and SBRT, (2010- present)
- Neuroscience Service Line Committee, Stanford, (2003- present)
- Co-Director, Stanford Cyberknife Program, Stanford, (2003- present)
- Director, Stanford Neuromolecular Innovation Program, (2009- present)
- Director, Stanford Neurogenetics Program, (2010- present)
- Robert C. and Jeannette Powell Professor in the Neurosciences, Stanford University, (2008- present)
- Vice Chairman, Neurosurgery Strategic Development and Innovation, Stanford University School of Medicine, (2015- present)

HONORS AND AWARDS

- Robert C. and Jeannette Powell Professor in the Neurosciences, Stanford University (2008-)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Member, Stanford Neurosciences Destination Service Line Committee (2002 - present)

PROFESSIONAL EDUCATION

- Residency: Stanford University Dept of Neurosurgery (1999) CA
- Internship: Stanford University Dept of General Surgery (1994) CA
- Medical Education: Stanford University School of Medicine (1993) CA
- Board Certification: Neurological Surgery, American Board of Neurological Surgery (2003)
- Fellowship: Stanford University Cerebrovascular Surgery Fellowship (2000) CA
- Fellowship, Stanford University Stereotactic Radiosurgery Fellowship , CA (1996)
- MD, Stanford University , Medicine (1993)
- AB, Stanford University , Quantitative Economics (1989)

- BS, Stanford University , Biology (1989)

COMMUNITY AND INTERNATIONAL WORK

- Stanford Brain Tumor Support Group
- Neurofibromatosis Support Group
- Stanford Meningioma Support Group, Stanford
- Stanford Acoustic Neuroma Support Group, Stanford

LINKS

- Stanford Neuromolecular Innovation Program: <http://snip.stanford.edu/>
- Stanford Neurogenetic Oncology Program: <http://stanfordhospital.org/clinicsmedServices/COE/neuro/neurogenetics/>
- Stanford Cyberknife Program: <https://stanfordhealthcare.org/medical-clinics/cyberknife-stereotactic-radiosurgery-program.html>
- Stanford Acoustic Neuroma Support Group: http://stanfordhospital.org/clinicsmedServices/COE/cyberknife/acoustic_neuroma.html
- Stanford Meningioma Support Group: <http://stanfordhospital.org/clinicsmedServices/COE/cyberknife/meningiomaSupport.html>
- Get a Second Opinion: <https://stanfordhealthcare.org/second-opinion/overview.html>

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

The Stanford Neurogenetic Innovation Program (SNIP) brings together clinical experts with the goal of developing new technologies to improve the diagnosis and treatment of patients affected by neurological conditions. Dr. Steven D. Chang, M.D., Professor of Neurosurgery, is leading SNIP's research efforts, which can be divided into three broad categories: (1) Neural Stem Cells, (2) New Blood Vessel Growth and Response to Radiosurgery, and (3) Nanotechnology and Microfluidic Biochips

1. Neural Stem Cells

SNIP researchers recently found that the ability of stem cells in the brain to regenerate themselves and produce new nerves is a process guided by signals from neighboring cells, in particular the cells that make up our blood vessels. SNIP researchers have succeeded in isolating stem cells from brain tumor tissue. It is possible that errors in the programming of these tumor stem cells may result in abnormal growth of tissue and the development of brain tumors. Similar to neural stem cells, these tumor stem cells are located around the blood vessels that feed the tumor. SNIP researchers are currently studying the stem cells present in brain tumors and vascular malformations to determine what changes occurred in these cells to cause them to produce or promote disease. With this knowledge, it may soon be possible to discover new therapies for affected patients, prevent recurrent tumor growth, identify genetic risk factors, and develop preventative therapies to protect against development of disease.

2. New Blood Vessel Growth and Response to Radiosurgery

Understanding the process by which new blood vessels grow in the brain is important for research on (1) stroke recovery, (2) Blood vascular malformations that are characterized by overgrowth or dysfunction of vascular elements, e.g. arteriovenous malformations, and (3) brain tumors, which grow on the basis of new blood vessel formation to feed the tumor. SNIP researchers have recently found that circulating cells, previously thought only to have functions in our immune system, are recruited to areas of new blood vessel growth in the brain. SNIP researchers hope to develop new therapies that travel through the bloodstream to affect this process in order to directly treat vascular malformations and brain tumors. SNIP researchers are examining genetic variation in key genes responsible for vascular health and response to radiation injury to explain patient variations in response to radiosurgery.

SNIP researchers are also leading efforts in biomarker discovery, a process that focuses on the isolation of circulating factors in the bloodstream of patients that may relate to specific characteristics of their tumor or vascular malformation. These biomarkers are being obtained on all patients undergoing neurosurgery for removal of their tumor or vascular malformation. Differences in biomarkers are being related to characteristics of the specimen obtained from surgery to determine whether these noninvasive measurements can reveal information specific to radiation susceptibility. Dr. Chang hopes to one day offer his patients a simple blood test that he can use to determine whether a particular patient will benefit from neurosurgery versus radiosurgery, i.e. the goal of practicing personalized medicine.

3. Nanotechnology and Microfluidic Biochips

Microfluidic systems can perform conventional chemical and molecular processes on a biochip, allowing for sample metering, mixing, reactions and detection#processes that usually require a laboratory full of equipment to be integrated and miniaturized onto chips no larger than the size of a standard glass slide. SNIP researchers are now focusing on prototyping new biochips to directly isolate specific cell populations and biomarkers using nanotechnology in order to develop tools that can enable SNIP clinicians to improve the diagnostics and treatment options available to patients affected by neurological conditions.

CLINICAL TRIALS

- Study Assessing QBS72S For Treating Brain Metastases of Triple Negative Breast Cancer, Recruiting
- Cyberknife Radiosurgery and Quality of Life, Not Recruiting
- Panitumumab-IRDye800 in Diagnosing Participants With Malignant Glioma Undergoing Surgery, Not Recruiting
- Phase 1-2 of Temozolomide and Hypofractionated Radiotherapy in Tx of Supratentorial Glioblastoma Multiform, Not Recruiting
- Phase I Compare OS in Post-CyberKnife Radiosurgery Tx in 1-3 VS 4 or More Brain Metastases, Not Recruiting
- Phase I Vorinostat Concurrent With Stereotactic Radiosurgery (SRS) in Brain Metastases From Non-Small Cell Lung Cancer, Not Recruiting
- Study of Fractionated Stereotactic Radiosurgery to Treat Large Brain Metastases, Not Recruiting

Publications

PUBLICATIONS

- **Stereotactic radiosurgery for trigeminal neuralgia secondary to tumor: a single-institution retrospective series.** *Neurosurgical focus*
Hall, J. C., Ung, T. H., McCleary, T. L., Chuang, C., Gibbs, I. C., Soltys, S. G., Hayden Gephart, M., Li, G., Pollom, E. L., Chang, S. D., Meola, A.
2022; 53 (5): E3
- **Stereotactic radiosurgery for recurrent pediatric brain tumors: clinical outcomes and toxicity.** *Neurosurgical focus*
Wang, E., Gutkin, P. M., Oh, J., Pollom, E., Soltys, S. G., Grant, G. A., Prolo, L. M., Chang, S., Li, G., Fisher, P. G., Partap, S., Campen, C. J., Gibbs, et al
2022; 53 (5): E2
- **Brain Metastases from Gynecologic Primary Cancers: Prognostic Factors for Local Control and Overall Survival**
Mendoza, M., Janchenko, L., von Eyben, R., Kidd, E., Pollom, E., Chang, S., Li, G., Kapp, D., Hayden, M., Soltys, S.
LIPPINCOTT WILLIAMS & WILKINS.2022: S34
- **The Molecular Basis and Pathophysiology of Trigeminal Neuralgia.** *International journal of molecular sciences*
Chen, Q., Yi, D. I., Perez, J. N., Liu, M., Chang, S. D., Barad, M. J., Lim, M., Qian, X.
2022; 23 (7)
- **Synchronous glioblastoma and brain metastases: illustrative case.** *Journal of neurosurgery. Case lessons*
Shahsavari, N., Ahmad, M., Sekar, V., Meola, A., Hancock, S. L., Chang, S. D., Chiang, V. L.
2022; 3 (12)
- **Post-operative Stereotactic Radiosurgery of Malignant Melanotic Schwannoma.** *Cureus*
Hall, J. C., Chang, S. D., Wilson, T. J., Ganjoo, K. N., Toland, A., Vogel, H., Pollom, E. L., Rahimy, E.
2022; 14 (3): e22849
- **Radiotherapy for brain metastases from thyroid cancer: an institutional and national retrospective cohort study.** *Thyroid : official journal of the American Thyroid Association*

- Blomain, E. S., Berta, S., Hug, N. F., Giao, D. M., Meola, A., Binkley, M. S., Hui, C., Churilla, T., Shahsavari, N., Desai, K., Chang, S. D., Soltys, S., Pollom, et al
2022
- **Stereotactic radiosurgery with immune checkpoint inhibitors for brain metastases: a meta-analysis study.** *British journal of neurosurgery*
Badrigilan, S., Meola, A., Chang, S. D., Rezaeian, S., Nemati, H., Almasi, T., Rostampour, N.
1800: 1-11
 - **Venous thromboembolism rates and risk factors following endoscopic skull base surgery.** *International forum of allergy & rhinology*
Chang, M. T., Jitaroon, K., Song, S., Roozdar, P., Wangworat, Y., Ibrahim, N., Ma, Y., Rao, V. K., Chang, S. D., Fernandez-Miranda, J. C., Patel, Z. M., Dodd, R. L., Hwang, et al
2021
 - **RADIOTHERAPY FOR BRAIN METASTASES FROM THYROID CANCER: A RETROSPECTIVE COHORT STUDY**
Blomain, E., Berta, S., Hug, N., Giao, D., Meola, A., Binkley, M., Shahsavari, N., Desai, K., Chang, S., Soltys, S., Pollom, E.
OXFORD UNIV PRESS INC.2021: 42
 - **Intracranial Response to Combination BRAF and MEK Inhibitor Therapy in Patients with Metastatic Melanoma**
Hui, C., Wu, Y., Liu, K., Sandhu, N., Blomain, E., Binkley, M., Gephart, M., Chang, S., Li, G., Reddy, S., Gibbs, I., Soltys, S., Pollom, et al
LIPPINCOTT WILLIAMS & WILKINS.2021: S48-S49
 - **SARS-CoV-2 infection and venous thromboembolism after surgery: an international prospective cohort study.** *Anaesthesia*
2021
 - **Letter: The Path to Surgical Robotics in Neurosurgery.** *Operative neurosurgery (Hagerstown, Md.)*
Walcott, B. P., Spetzler, R. F., Chang, S. D., Muacevic, A., Moll, F., Adler, J. R.
2021
 - **Tumor Control Following Stereotactic Radiosurgery in Patients with Vestibular Schwannomas - A Retrospective Cohort Study.** *Otology & neurotology : official publication of the American Otological Society, American Neurotology Society [and] European Academy of Otology and Neurotology*
Santa Maria, P. L., Shi, Y., Aaron, K. A., Gurgel, R. K., Corrales, C. E., Soltys, S. G., Santa Maria, C., Chang, S. D., Blevins, N. H., Jackler, R. K., Gibbs, I. C.
2021
 - **Radiosurgery as a microsurgical adjunct: outcomes after microsurgical resection of intracranial arteriovenous malformations previously treated with stereotactic radiosurgery.** *Journal of neurosurgery*
Bigder, M., Choudhri, O., Gupta, M., Gummidipundi, S., Han, S. S., Church, E. W., Chang, S. D., Levy, R. P., Do, H. M., Marks, M. P., Steinberg, G. K.
2021: 1-12
 - **Microsurgical resection of foramen magnum meningioma: multi-institutional retrospective case series and proposed surgical risk scoring system.** *Journal of neuro-oncology*
Fatima, N., Shin, J. H., Curry, W. T., Chang, S. D., Meola, A.
2021
 - **The Stanford stereotactic radiosurgery experience on 7000 patients over 2 decades (1999-2018): looking far beyond the scalpel.** *Journal of neurosurgery*
Fatima, N., Meola, A., Ding, V. Y., Pollom, E., Soltys, S. G., Chuang, C. F., Shahsavari, N., Hancock, S. L., Gibbs, I. C., Adler, J. R., Chang, S. D.
2021: 1-17
 - **Timing of surgery following SARS-CoV-2 infection: an international prospective cohort study** *ANAESTHESIA*
Nepogodiev, D., COVIDSurg Collaborative, GlobalSurg Collaborative
2021; 76 (6): 748-758
 - **Improved survival and disease control following pembrolizumab-induced immune-related adverse events in high PD-L1 expressing non-small cell lung cancer with brain metastases.** *Journal of neuro-oncology*
Zhang, M. n., Rodrigues, A. J., Pollom, E. L., Gibbs, I. C., Soltys, S. G., Hancock, S. L., Neal, J. W., Padda, S. K., Ramchandran, K. J., Wakelee, H. A., Chang, S. D., Lim, M. n., Hayden Gephart, et al
2021
 - **Phase I/II Dose-Escalation Trial of 3-Fraction Stereotactic Radiosurgery for Resection Cavities From Large Brain Metastases: Health-related Quality of Life Outcomes.** *American journal of clinical oncology*
Rahimy, E., Dudley, S. A., von Eyben, R., Pollom, E. L., Seiger, K., Modlin, L., Wynne, J., Fujimoto, D., Jacobs, L. R., Chang, S. D., Gibbs, I. C., Hancock, S. L., Adler, et al
2021; 44 (11): 588-595

- **Financial Toxicity in Patients with Brain and Spine Metastases.** *World neurosurgery*
Koenig, J. L., Sandhu, N. n., Sborov, K. n., Sabolch, A. n., Usoz, M. n., Li, G. n., Gephart, M. H., Chang, S. n., Hiniker, S. n., Soltys, S. G., Pollom, E. L.
2021
- **Intracranial Autograft Fat Placement to Separate the Optic Chiasm from Tumor to Improve Stereotactic Radiotherapy Dosimetry.** *World neurosurgery*
Turner, B. E., Schuler, E., Chang, S. D., Harsh, G. R., Soltys, S. G.
2020
- **Efficacy and safety of embolization of dural arteriovenous fistulas via the ophthalmic artery.** *Interventional neuroradiology : journal of peritherapeutic neuroradiology, surgical procedures and related neurosciences*
Mayercik, V. A., Sussman, E. S., Pulli, B., Dodd, R. L., Do, H. M., Telischak, N. A., Marks, M. P., Steinberg, G. K., Chang, S. D., Heit, J. J.
2020: 1591019920969270
- **Evidence for endothelial-to-mesenchymal transition in human brain arteriovenous malformations.** *Clinical and translational medicine*
Shoemaker, L. D., McCormick, A. K., Allen, B. M., Chang, S. D.
2020
- **Stereotactic radiosurgery for head and neck paragangliomas: a systematic review and meta-analysis.** *Neurosurgical review*
Fatima, N., Pollom, E., Soltys, S., Chang, S. D., Meola, A.
2020
- **Stereotactic Radiosurgery for Benign Spinal Tumors.** *Neurosurgery clinics of North America*
Meola, A., Soltys, S., Schmitt, A., Gerszten, P. C., Chang, S. D.
2020; 31 (2): 231–35
- **Arterial-spin labeling MRI identifies residual cerebral arteriovenous malformation following stereotactic radiosurgery treatment** *JOURNAL OF NEURORADIOLOGY*
Heit, J. J., Thakur, N. H., Iv, M., Fischbein, N. J., Wintermark, M., Dodd, R. L., Steinberg, G. K., Chang, S. D., Kapadia, K. B., Zaharchuk, G.
2020; 47 (1): 13–19
- **A Phase I/II Trial of 5-Fraction Stereotactic Radiosurgery with 5-mm Margins with Concurrent Temozolomide in Newly Diagnosed Glioblastoma: Primary Outcomes.** *Neuro-oncology*
Azoulay, M. n., Chang, S. D., Gibbs, I. C., Hancock, S. L., Pollom, E. L., Harsh, G. R., Adler, J. R., Harrahar, C. n., Li, G. n., Hayden Gephart, M. n., Nagpal, S. n., Thomas, R. P., Recht, et al
2020
- **Intracranial Tumor Control Following Immune-Related Adverse Events and Discontinuation of Immunotherapy for Melanoma.** *World neurosurgery*
Zhang, M. n., Rodrigues, A. J., Bhambhvani, H. P., Fatemi, P. n., Pollom, E. L., Gibbs, I. C., Thomas, R. P., Soltys, S. G., Hancock, S. L., Chang, S. D., Reddy, S. A., Gephart, M. H., Li, et al
2020
- **Stereotactic Radiosurgery for Resected Brain Metastases - Does the Surgical Corridor Need to be Targeted?** *Practical radiation oncology*
Shi, S. n., Sandhu, N. n., Jin, M. n., Wang, E. n., Liu, E. n., Jaoude, J. A., Schofield, K. n., Zhang, C. n., Gibbs, I. C., Hancock, S. L., Chang, S. D., Li, G. n., Gephart, et al
2020
- **Predictors of visual functional outcome following treatment for cavernous sinus meningioma.** *Journal of neurosurgery*
Fatima, N. n., Ding, V. Y., Han, S. S., Chang, S. D., Meola, A. n.
2020: 1–12
- **Local control and toxicity outcomes of stereotactic radiosurgery for spinal metastases of gastrointestinal origin.** *Journal of neurosurgery. Spine*
Sandhu, N. n., Benson, K. R., Kumar, K. A., Eyben, R. V., Chang, D. T., Gibbs, I. C., Hancock, S. L., Meola, A. n., Chang, S. D., Li, G. n., Hayden-Gephart, M. n., Soltys, S. G., Pollom, et al
2020: 1–8
- **Evaluating Surgical Resection Extent and Adjuvant Therapy in the Management of Gliosarcoma.** *Frontiers in oncology*
Jin, M. C., Liu, E. K., Shi, S. n., Gibbs, I. C., Thomas, R. n., Recht, L. n., Soltys, S. G., Pollom, E. L., Chang, S. D., Hayden Gephart, M. n., Nagpal, S. n., Li, G. n.
2020; 10: 337
- **Long-Term Update of Stereotactic Radiosurgery for Benign Spinal Tumors** *NEUROSURGERY*

- Chin, A. L., Fujimoto, D., Kumar, K. A., Tupper, L., Mansour, S., Chang, S. D., Adler, J. R., Gibbs, I. C., Hancock, S. L., Dodd, R., Li, G., Gephart, M., Ratliff, et al
2019; 85 (5): 708–16
- **Long-Term Hearing Outcomes Following Stereotactic Radiosurgery in Vestibular Schwannoma Patients-A Retrospective Cohort Study**
Santa Maria, P. L., Shi, Y., Gurgel, R. K., Corrales, C., Soltys, S. G., Santa Maria, C., Murray, K., Chang, S. D., Blevins, N. H., Gibbs, I. C., Jackler, R. K.
OXFORD UNIV PRESS INC.2019: 550–59
 - **Stereotactic Radiosurgery for Resected Brain Metastases: Single-Institutional Experience of over 500 Cavities**
Shi, S., Sandhu, N., Wang, E. H., Liu, E., Jaoude, J., Jin, M., Schofield, K., Zhang, C., Gibbs, I. C., Hancock, S. L., Chang, S. D., Li, G., Hayden, et al
ELSEVIER SCIENCE INC.2019: E90
 - **Spinal Cord Tolerance Guided by Stereotactic Radiosurgical Treatment of Intramedullary Arteriovenous Malformations**
Obeid, J. P., Muftuoglu, Y., Chang, S. D., Soltys, S. G.
ELSEVIER SCIENCE INC.2019: E124
 - **Vertebral Compression Fracture Rates after Stereotactic Radiosurgery for Spinal Metastases**
Usoz, M., Dhillon, J., Kumar, K. A., Von Eyben, R., White, E. C., Ho, C. K., Azoulay, M., Fujimoto, D. K., Gibbs, I. C., Chang, S. D., Hancock, S. L., Pollom, E., Soltys, et al
ELSEVIER SCIENCE INC.2019: E126–E127
 - **Factors Associated with Treatment Failure and Radiation Necrosis Following Cavity Radiosurgery for Resected Brain Metastases**
Wang, E. H., Shi, S., Sandhu, N., Liu, E., Jin, M., Schofield, K., Zhang, C., Jaoude, J., Gibbs, I. C., Hancock, S. L., Chang, S. D., Li, G., Hayden, et al
ELSEVIER SCIENCE INC.2019: E92
 - **Stereotactic Radiosurgery for Small Cell Lung Cancer Brain Metastases**
Bagshaw, H. P., Taggarsi, R. S., Moding, E. J., Fawaz, Z. S., Von Eyben, R., Pollom, E., Chang, S. D., Gibbs, I. C., Hancock, S. L., Soltys, S. G.
ELSEVIER SCIENCE INC.2019: E70–E71
 - **Multimodal management of arteriovenous malformations of the basal ganglia and thalamus: factors affecting obliteration and outcome** *JOURNAL OF NEUROSURGERY*
Madhugiri, V. S., Teo, M. C., Westbrook, E. M., Chang, S. D., Marks, M. P., Do, H. M., Levy, R. P., Steinberg, G. K.
2019; 131 (2): 410–19
 - **Ultrasml theranostic gadolinium-based nanoparticles improve high-grade rat glioma survival.** *Journal of clinical neuroscience : official journal of the Neurosurgical Society of Australasia*
Dufort, S., Appelboom, G., Verry, C., Barbier, E. L., Lux, F., Brauer-Krisch, E., Sancey, L., Chang, S. D., Zhang, M., Roux, S., Tillement, O., Le Duc, G.
2019
 - **Commentary: Peritumoral Edema/Tumor Volume Ratio: A Strong Survival Predictor for Posterior Fossa Metastases** *NEUROSURGERY*
Chow, K. H., Meola, A., Chang, S. D.
2019; 85 (1): E18–E19
 - **Stereotactic radiosurgery in large intracranial meningiomas: a systematic review.** *World neurosurgery*
Fatima, N., Meola, A., Pollom, E., Chaudhary, N., Soltys, S., Chang, S.
2019
 - **Adverse Radiation Effect and Disease Control in Patients Undergoing Stereotactic Radiosurgery and Immune Checkpoint Inhibitor Therapy for Brain Metastases** *WORLD NEUROSURGERY*
Koenig, J. L., Shi, S., Sborov, K., Gensheimer, M. F., Le, G., Nagpal, S., Chang, S. D., Gibbs, I. C., Soltys, S. G., Pollom, E. L.
2019; 126: E1399–E1411
 - **Efficacy and toxicity of particle radiotherapy in WHO grade II and grade III meningiomas: a systematic review.** *Neurosurgical focus*
Wu, A., Jin, M. C., Meola, A., Wong, H., Chang, S. D.
2019; 46 (6): E12
 - **Magnetic Particle Imaging in Neurosurgery** *WORLD NEUROSURGERY*
Meola, A., Rao, J., Chaudhary, N., Song, G., Zheng, X., Chang, S. D.
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