



Laser Catheter Placement:

Singh H, Osswald CR, Rossman A, et al. **Preclinical assessment of a noncooled MR thermometry–based neurosurgical laser therapy system.** *Journal of Neurosurgery*. Published online March 08, 2024. [doi:10.3171/2023.12.JNS232154](https://doi.org/10.3171/2023.12.JNS232154)

Wilson H, Dhawan S, Do TH, et al. **The ClearPoint Prism® Laser Ablation System: A New Platform for Laser Interstitial Thermal Therapy (LITT) in Neuro-Oncology.** *Neurosurgery Practice*. 5(1):e00084, March 2024. [doi:10.1227/neuprac.0000000000000084](https://doi.org/10.1227/neuprac.0000000000000084)

Zagorchev L, Hyde DE, Li C, et al. **Shape-constrained deformable brain segmentation: Methods and quantitative validation.** *NeuroImage*. Volume 289, 2024, 120542, ISSN 1053-8119. [doi:10.1016/j.neuroimage.2024.120542](https://doi.org/10.1016/j.neuroimage.2024.120542)

Hamade YJ, Mehrotra A, Chen CC. **Stereotactic needle biopsy and laser ablation of geographically distinct lesions through a novel magnetic resonance imaging-compatible cranial stereotaxic frame: illustrative case.** *J Neurosurg Case Lessons*. 2023;5(2):CASE22448. Published 2023 Jan 9. [doi:10.3171/CASE22448](https://doi.org/10.3171/CASE22448)

Chen B, Grewal SS, Middlebrooks EH, Tatum WO, et al. **Intraoperative electrocorticography during laser- interstitial thermal therapy predicts seizure outcome in mesial temporal lobe epilepsy.** *Clin Neurophysiol*. 2023;146:118-123. [doi:10.1016/j.clinph.2022.12.003](https://doi.org/10.1016/j.clinph.2022.12.003)

Buch VP, Mirro EA, Purger DA, Zeineh M, et al. **Magnetic resonance imaging–guided laser interstitial thermal therapy for refractory focal epilepsy in a patient with a fully implanted RNS system: illustrative case.** *Journal of Neurosurgery: Case Lessons*. 2022; 3(21), CASE22117. [doi:10.3171/CASE22117](https://doi.org/10.3171/CASE22117)

Sterk B, Taha B, Osswald C, Bell R, Chen L, Chen CC. **Initial clinical experience with ClearPoint SmartFrame Array®- aided stereotactic procedures.** *World Neurosurg*. 2022;162:e120-e130. [doi:10.1016/j.wneu.2022.02.095](https://doi.org/10.1016/j.wneu.2022.02.095)

Rich CW, Fasano RE, Isbaine F, Saindane AM, et al. **MRI-guided stereotactic laser corpus callosotomy for epilepsy: distinct methods and outcomes.** *Journal of Neurosurgery*. 2021; Published online ahead of print. [doi:10.3171/2020.7.JNS20498](https://doi.org/10.3171/2020.7.JNS20498)

Hong CS, Beckta JM, Kundishora AJ, Elsamadicy AA, Chiang VL. **Laser interstitial thermal therapy for treatment of cerebral radiation necrosis.** *International Journal of Hyperthermia*. 2020;37(2):68-76. [doi:10.1080/02656736.2020.1760362](https://doi.org/10.1080/02656736.2020.1760362)

Gupta K, Cabaniss B, Kheder A, Gedela S, et al. **Stereotactic MRI-guided laser interstitial thermal therapy for extratemporal lobe epilepsy.** *Epilepsia*. 2020; 00:1-12. [doi: 10.1111/epi.16614](https://doi.org/10.1111/epi.16614)

*Zervos TM, Scarpace L, Robin AM, Schwalb JM, Air EL. **Adapting to space limitations during prone real-time magnetic resonance imaging-guided stereotaxic laser ablation: Technical pearls.** *Operative Neurosurgery*. 2019;18(4). [doi:10.1093/ons/opz173](https://doi.org/10.1093/ons/opz173)

Bartek J, Alattar A, Jensdottir M, Chen CC. **Biopsy and ablation of H3K27 glioma using skull-mounted Smartframe device: Technical case report.** *World Neurosurgery*. 2019;127:436-441. [doi:10.1016/j.wneu.2019.04.029](https://doi.org/10.1016/j.wneu.2019.04.029)

Ahluwalia M, Barnett GH, Deng D, Tatter SB, et al. **Laser ablation after stereotactic radiosurgery: a multicenter prospective study in patients with metastatic brain tumors and radiation necrosis.** *Journal of Neurosurgery*. 2019;130(3):804-811. [doi:10.3171/2017.11.jns171273](https://doi.org/10.3171/2017.11.jns171273)

Harris M, Steele J, Williams R, Pinkston J, Zweig R, Wilden JA. **MRI-guided laser interstitial thermal thalamotomy for medically intractable tremor disorders.** *Movement Disorders*. 2018;34(1):124-129. [doi:10.1002/mds.27545](https://doi.org/10.1002/mds.27545)

*Ho AL, Sussman ES, Pendharkar AV, Le S, et al. **Improved operative efficiency using a real-time MRI-guided stereotactic platform for laser amygdalohippocampotomy.** *Journal of Neurosurgery*. 2018;128(4):1165-1172. [doi:10.3171/2017.1.jns162046](https://doi.org/10.3171/2017.1.jns162046)

Larson PS, Vadivelu S, Azmi-Ghadimi H, Nichols A, Fauerbach L, Johnson HB. **Neurosurgical laser ablation and MR thermometry: Risks of multisite workflow pattern.** *Journal of Healthcare Risk Management*. 2017;36(4):7-18. [doi:10.1002/jhrm.21258](https://doi.org/10.1002/jhrm.21258)

Rennert RC, Carroll KT, Ali MA, Hamelin T, et al. **Safety of stereotactic laser ablations performed as treatment for glioblastomas in a conventional magnetic resonance imaging suite.** *Neurosurgical Focus*. 2016;41(4). [doi:10.3171/2016.8.focus16217](https://doi.org/10.3171/2016.8.focus16217)

Ali MA, Carroll KT, Rennert RC, Hamelin T, et al. **Stereotactic laser ablation as treatment for brain metastases that recur after stereotactic radiosurgery: a multiinstitutional experience.** *Neurosurgical Focus*. 2016;41(4). [doi:10.3171/2016.7.focus16227](https://doi.org/10.3171/2016.7.focus16227)

*Torcuator RG, Hulou MM, Chavakula V, Jolesz FA, Golby AJ. **Intraoperative real-time MRI-guided stereotactic biopsy followed by laser thermal ablation for progressive brain metastases after radiosurgery.** *Journal of Clinical Neuroscience*. 2016;24:68-73. [doi:10.1016/j.jocn.2015.09.008](https://doi.org/10.1016/j.jocn.2015.09.008)

Mccracken DJ, Willie JT, Fernald BA, Saindane AM, et al. **Magnetic resonance thermometry-guided stereotactic laser ablation of cavernous malformations in drug-resistant epilepsy: Imaging and clinical results.** *Operative Neurosurgery*. 2015;12(1):39-48. [doi:10.1227/neu.0000000000001033](https://doi.org/10.1227/neu.0000000000001033)

Gross RE, Willie JT, Drane DL. **The role of stereotactic laser Amygdalohippocampotomy in Mesial temporal lobe epilepsy.** *Neurosurgery Clinics of North America*. 2016;27(1):37-50. [doi:10.1016/j.nec.2015.08.004](https://doi.org/10.1016/j.nec.2015.08.004)

*Gross RE, Willie JT. **Response to journal club: Real-time magnetic resonance-guided stereotactic laser Amygdalohippocampotomy for Mesial Temporal Lobe Epilepsy.** *Neurosurgery*. 2015;77(3). [doi:10.1227/neu.0000000000000876](https://doi.org/10.1227/neu.0000000000000876)

Drane DL, Loring DW, Voets NL, Price M, et al. **Better object recognition and naming outcome with MRI-guided stereotactic laser amygdalohippocampotomy for temporal lobe epilepsy.** *Epilepsia*. 2014;56(1):101-113. [doi:10.1111/epi.12860](https://doi.org/10.1111/epi.12860)

Willie JT, Tung JK, Gross RE. **Chapter 16: MRI-guided stereotactic laser ablation.** *Image-Guided Neurosurgery*. 2015:375-403. [doi:10.1016/b978-0-12-800870-6.00016-9](https://doi.org/10.1016/b978-0-12-800870-6.00016-9)

*Willie JT, Laxpati NG, Drane DL, Gowda A, et al. **Real-time magnetic resonance-guided stereotactic laser Amygdalohippocampotomy for Mesial Temporal Lobe Epilepsy.** *Neurosurgery*. 2014;74(6):569-585. [doi:10.1227/neu.0000000000000343](https://doi.org/10.1227/neu.0000000000000343)

DBS Lead Placement:

Zagorchev L, Hyde DE, Li C, et al. **Shape-constrained deformable brain segmentation: Methods and quantitative validation.** *NeuroImage*. Volume 289, 2024, 120542, ISSN 1053-8119. [doi:10.1016/j.neuroimage.2024.120542](https://doi.org/10.1016/j.neuroimage.2024.120542)

Yearley AG, Chua M, Horn A, Cosgrove GR, Rolston JD. **Deep Brain Stimulation Lead Localization Variability Comparing Intraoperative MRI Versus Postoperative Computed Tomography** [published online ahead of print, 2023 Aug 16]. *Oper Neurosurg (Hagerstown)*. 2023;10.1227/ons.0000000000000849. [doi:10.1227/ons.0000000000000849](https://doi.org/10.1227/ons.0000000000000849)

Harland TA, Brougham J, Gupta S, Strahan J, Hefner M, Wilden J. **A Modified Technique for Interventional MRI-Guided Deep Brain Stimulation Using the ClearPoint System.** *Oper Neurosurg (Hagerstown)*. 2023;25(1):81-86. [doi:10.1227/ons.0000000000000698](https://doi.org/10.1227/ons.0000000000000698)

Lee AT, Han KJ, Nichols N, Sudhakar VR, Burke JF, Wozny TA, Chung JE, Volz MM, Ostrem JL, Martin AJ, Larson PS, Starr PA, Wang DD. **Targeting Accuracy and Clinical Outcomes of Awake Vs Asleep Interventional MRI-Guided Deep Brain Stimulation for Parkinson's Disease: The UCSF Experience.** *Neurosurgery*. 2022 Sep 7. Epub ahead of print. PMID: 36069560. [doi:10.1227/neu.0000000000002111](https://doi.org/10.1227/neu.0000000000002111)

The information presented in this article is a scientific and medical discussion of a peer reviewed journal article presenting data from a retrospective, non-randomized study describing DBS techniques. Certain authors of this study received non-financial research support from ClearPoint Neuro during the time period of the study.

Burdette DE, Haykal MA, Jarosiewicz B, Fabris RR, et al. **Brain-responsive corticothalamic stimulation in the centromedian nucleus for the treatment of regional neocortical epilepsy.** *Epilepsy & Behavior*. 2020;112. [doi:10.1016/j.yebeh.2020.107354](https://doi.org/10.1016/j.yebeh.2020.107354)

Gummadavelli A, Zaveri HP, Spencer DD, Gerrard JL. **Expanding brain-computer interfaces for controlling epilepsy networks: Novel thalamic responsive neurostimulation in refractory epilepsy.** *Frontiers in Neuroscience*. 2018;12:474. [doi:10.3389/fnins.2018.00474](https://doi.org/10.3389/fnins.2018.00474)

Martin AJ, Larson PS, Ziman N, Levesque N, et al. **Deep brain stimulator implantation in a diagnostic MRI suite: infection history over a 10-year period.** *Journal of Neurosurgery*. 2017;126(1):108-113. [doi:10.3171/2015.7.ins15750](https://doi.org/10.3171/2015.7.ins15750)

Lahue SC, Ostrem JL, Galifianakis NB, Luciano MS, et al. **Parkinson's disease patient preference and experience with various methods of DBS lead placement.** *Parkinsonism & Related Disorders*. 2017;41:25-30. [doi:10.1016/j.parkreldis.2017.04.010](https://doi.org/10.1016/j.parkreldis.2017.04.010)

Sidiropoulos C, Rammo R, Merker B, Mahajan A, et al. **Intraoperative MRI for deep brain stimulation lead placement in Parkinson's disease: 1 year motor and neuropsychological outcomes.** *Journal of Neurology*. 2016;263(6):1226-1231. [doi:10.1007/s00415-016-8125-0](https://doi.org/10.1007/s00415-016-8125-0)

Chansakul T, Chen PN, Lee TC, Tierney T. **Interventional MR imaging for deep brain stimulation electrode placement.** *Radiology*. 2016;281(3):940-946. [doi:10.1148/radiol.2015151136](https://doi.org/10.1148/radiol.2015151136)

Rolston JD, Englot DJ, Starr PA, Larson PS. **An unexpectedly high rate of revisions and removals in deep brain stimulation surgery: Analysis of multiple databases.** *Parkinsonism & Related Disorders*. 2016;33:72-77. [doi:10.1016/j.parkreldis.2016.09.014](https://doi.org/10.1016/j.parkreldis.2016.09.014)

Azmi H, Gupta F, Vukic M, Kreitner J, et al. **Interventional magnetic resonance imaging-guided subthalamic nucleus deep brain stimulation for Parkinson's disease: Patient selection.** *Surgical Neurology International*. 2016;7(20):557. [doi:10.4103/2152-7806.187537](https://doi.org/10.4103/2152-7806.187537)

Southwell DG, Narvid JA, Martin AJ, Qasim SE, Starr PA, Larson PS. **Comparison of deep brain stimulation lead targeting accuracy and procedure duration between 1.5- and 3-Tesla interventional magnetic resonance imaging systems: An initial 12-month experience.** *Stereotactic and Functional Neurosurgery*. 2016;94(2):102-107. [doi:10.1159/000443407](https://doi.org/10.1159/000443407)

Ostrem JL, Ziman N, Galifianakis NB, Starr PA, et al. **Clinical outcomes using ClearPoint interventional MRI for deep brain stimulation lead placement in Parkinson's disease.** *Journal of Neurosurgery*. 2016;124(4):908-916. [doi:10.3171/2015.4.jns15173](https://doi.org/10.3171/2015.4.jns15173)

Larson PS, et al. (2016). **Interventional MRI-Guided DBS: A Practical Atlas.** This book is available for download with iBooks on your Mac or iOS device: <https://books.apple.com/us/book/interventional-mri-guided-dbs/id554568402>

Sidiropoulos C, Mubita L, Krstevska S, Schwalb JM. **Successful Vim targeting for mixed essential and parkinsonian tremor using intraoperative MRI.** *Journal of the Neurological Sciences*. 2015;358(1-2):488-489. [doi:10.1016/j.jns.2015.08.1553](https://doi.org/10.1016/j.jns.2015.08.1553)

Chabardes S, Isnard S, Castrioto A, Oddoux M, et al. **Surgical implantation of STN-DBS leads using intraoperative MRI guidance: technique, accuracy, and clinical benefit at 1-year follow-up.** *Acta Neurochirurgica*. 2015;157(4):729-737. [doi:10.1007/s00701-015-2361-4](https://doi.org/10.1007/s00701-015-2361-4)

Ivan ME, Yarlagadda J, Saxena AP, Martin AJ, et al. **Brain shifts during burr hole-based procedures using interventional MRI.** *Journal of Neurosurgery*. 2014;121(1):149-160. [doi:10.3171/2014.3.jns121312](https://doi.org/10.3171/2014.3.jns121312)

Starr PA, Markun LC, Larson PS, Volz MM, Martin AJ, Ostrem JL. **Interventional MRI-guided deep brain stimulation in pediatric dystonia: first experience with the ClearPoint system.** *Journal of Neurosurgery: Pediatrics*. 2014;14(4):400-408. [doi:10.3171/2014.6.peds13605](https://doi.org/10.3171/2014.6.peds13605)

Vega RA, Holloway KL, Larson PS. **Image-guided deep brain stimulation.** *Neurosurgery Clinics of North America*. 2014;25(1):159-172. [doi:10.1016/j.nec.2013.08.008](https://doi.org/10.1016/j.nec.2013.08.008)

Sillay KA, Rusy D, Buyan-Dent L, Ninman NL, Vigen KK. **Wide-bore 1.5T MRI-guided deep brain stimulation surgery: initial experience and technique comparison.** *Clinical Neurology and Neurosurgery*. 2014;127:79-85. [doi:10.1016/j.clineuro.2014.09.017](https://doi.org/10.1016/j.clineuro.2014.09.017)

Larson PS, Starr PA, Ostrem JL, Galifianakis N, Palenzuela MSL, Martin A. **Application accuracy of a second generation interventional MRI stereotactic platform.** *Neurosurgery*. 2013;60:187. [doi:10.1227/01.neu.0000432793.68257.ab](https://doi.org/10.1227/01.neu.0000432793.68257.ab)

Ostrem J, Galifianakis N, Markun L, Grace JK, et al. **Clinical outcomes of PD patients having bilateral STN DBS using high-field interventional MR-imaging for lead placement.** *Clinical Neurology and Neurosurgery*. 2013;115(6):708-712. [doi:10.1016/j.clineuro.2012.08.019](https://doi.org/10.1016/j.clineuro.2012.08.019)

Larson PS, Starr PA, Bates G, Tansey L, et al. **An optimized system for interventional magnetic resonance imaging-guided stereotactic surgery: preliminary evaluation of targeting accuracy.** *Neurosurgery*. 2012 Mar;70(1 Suppl Operative):95-103; discussion 103. [doi: 10.1227/NEU.0b013e31822f4a91](https://doi.org/10.1227/NEU.0b013e31822f4a91)

Biopsy:

Wilson H, Dhawan S, Do TH, et al. **The ClearPoint Prism® Laser Ablation System: A New Platform for Laser Interstitial Thermal Therapy (LITT) in Neuro-Oncology.** *Neurosurgery Practice.* 5(1):e00084, March 2024. [doi:10.1227/neuprac.0000000000000084](https://doi.org/10.1227/neuprac.0000000000000084)

Zagorchev L, Hyde DE, Li C, et al. **Shape-constrained deformable brain segmentation: Methods and quantitative validation.** *NeuroImage.* Volume 289, 2024, 120542, ISSN 1053-8119. [doi:10.1016/j.neuroimage.2024.120542](https://doi.org/10.1016/j.neuroimage.2024.120542)

Dhawan S, Chen CC. **Comparison meta-analysis of intraoperative MRI-guided needle biopsy versus conventional stereotactic needle biopsies.** *Neurooncol Adv.* 2023;6(1):vdad129. Published 2023 Oct 10. [doi:10.1093/oaajnl/vdad129](https://doi.org/10.1093/oaajnl/vdad129)

Ling AL, Solomon IH, Landivar AM, et al. **Clinical trial links oncolytic immunoactivation to survival in glioblastoma.** *Nature* 623. 157–166 (2023). [doi:10.1038/s41586-023-06623-2](https://doi.org/10.1038/s41586-023-06623-2)

Dhawan S, Chen CC. **Comparison meta-analysis of intra-operative MRI-guided needle biopsy versus conventional stereotactic needle biopsies.** *Neuro-Oncology Advances.* 2023;vdad129. [doi:10.1093/oaajnl/vdad129](https://doi.org/10.1093/oaajnl/vdad129)

Cruz-Garza JG, Taghlabi KM, Bhenderu LS, Gupta S, et al. **Magnetic Resonance-Guided Stereotaxy for Infusions to the Pig Brain.** *JoVE Journal Neuroscience.* Published online: 31 March 2023. [doi:10.3791/64079-v](https://doi.org/10.3791/64079-v)

Hamade YJ, Mehrotra A, Chen CC. **Stereotactic needle biopsy and laser ablation of geographically distinct lesions through a novel magnetic resonance imaging-compatible cranial stereotaxic frame: illustrative case.** *J Neurosurg Case Lessons.* 2023;5(2):CASE22448. Published 2023 Jan 9. [doi:10.3171/CASE22448](https://doi.org/10.3171/CASE22448)

Taha BR, Osswald CR, Rabon M, Garcia CS, et al. **Learning Curve Associated with ClearPoint Neuronavigation System: A Case Series.** *World Neurosurgery.* X. 2022;13: 100115. [doi:10.1016/j.wnsx.2021.100115](https://doi.org/10.1016/j.wnsx.2021.100115)

Bartek J Jr, Alattar A, Jensdottir M, Chen CC. **Biopsy and ablation of H3K27 glioma using skull-mounted Smartframe Device: Technical case report.** *World Neurosurgery.* 2019;127:436–441. [doi:10.1016/j.wneu.2019.04.029](https://doi.org/10.1016/j.wneu.2019.04.029)

Carroll KT, Lochte BC, Chen JY, Snyder VS, Carter BS, Chen CC. **Intraoperative magnetic resonance imaging-guided biopsy in the diagnosis of Suprasellar Langerhans Cell Histiocytosis.** *World Neurosurgery.* 2018;112:6–13. [doi:10.1016/j.wneu.2017.12.184](https://doi.org/10.1016/j.wneu.2017.12.184)

Mohyeldin A & Elder JB. **Stereotactic biopsy platforms with intraoperative imaging guidance.** *Neurosurgery Clinics of North America.* 2017;28(4):465–475. [doi:10.1016/j.nec.2017.05.002](https://doi.org/10.1016/j.nec.2017.05.002)

*Scheer JK, Hamelin T, Chang L, Lemkuil B, Carter BS, Clark CC. **Real-time magnetic resonance imaging-guided biopsy using SmartFrame® stereotaxis in the setting of a conventional diagnostic magnetic resonance imaging suite.** *Operative Neurosurgery.* 2017;13(3):329–337. [doi:10.1093/ons/opw035](https://doi.org/10.1093/ons/opw035)

*Torcuator RG, Hulou MM, Chavakula V, Jolesz FA, Golby AJ. **Intraoperative real-time MRI-guided stereotactic biopsy followed by laser thermal ablation for progressive brain metastases after radiosurgery.** *Journal of Clinical Neuroscience.* 2016;24:68–73. [doi:10.1016/j.jocn.2015.09.008](https://doi.org/10.1016/j.jocn.2015.09.008)

*Mohyeldin A, Lonser RR, Elder JB. **Real-time magnetic resonance imaging-guided frameless stereotactic brain biopsy: technical note.** *Journal of Neurosurgery.* 2016;124(4):1039–1046. [doi:10.3171/2015.5.JNS1589](https://doi.org/10.3171/2015.5.JNS1589)

Drug Delivery: *(For scientific information purposes only; Therapies discussed may not be approved in all geographies or may be investigational and used only in pre-clinical and clinical studies.)*

Zagorchev L, Hyde DE, Li C, et al. **Shape-constrained deformable brain segmentation: Methods and quantitative validation.** *NeuroImage*. Volume 289, 2024, 120542, ISSN 1053-8119. [doi:10.1016/j.neuroimage.2024.120542](https://doi.org/10.1016/j.neuroimage.2024.120542)

Qiu L, Xu E, Chambule S, LaTourette P, Dyer CD, et al. **Magnetic Resonance Imaging–Guided Frameless Stereotactic Injections of the Bilateral Cerebellar Dentate Nuclei in Nonhuman Primates: Technical Note.** *Operative Neurosurgery*. 10.1227/ons.0000000000001050, February 1, 2024. [doi:10.1227/ons.0000000000001050](https://doi.org/10.1227/ons.0000000000001050)

Blum D, Babu H, Beach R, et al. **First-in-Human Trial of NRTX-1001 GABAergic Interneuron Cell Therapy for Treatment of Focal Epilepsy - Emerging Clinical Trial Results.** *In: Proceedings from the American Epilepsy Society*. December 1-5, 2023; Orlando, FL. [Abstract 2.306](#)

François-Heude MC, Poulen G, Flamand Roze E, et al. **Intrapataminal Gene Delivery in Two Patients with Aromatic L-Amino Acid Decarboxylase Deficiency.** *Mov Disord Clin Pract*. 2023;10(5):811-818. Published 2023 Feb 24. [doi:10.1002/mdc3.13685](https://doi.org/10.1002/mdc3.13685)

Pino IP, Darrow DP, Chen CC. **MRI-aided SmartFlow convection delivery of DNX-2401: a pilot, prospective case series.** *World Neurosurgery*. 2023, ISSN 1878-8750. [doi:10.1016/j.wneu.2023.10.142](https://doi.org/10.1016/j.wneu.2023.10.142)
The ClearPoint system enables intraprocedural MRI guidance for a number of neurological therapies and approved clinical trials.

Ford MM, George BE, Van Laar VS, et al. **GDNF gene therapy for alcohol use disorder in male non-human primates.** *Nat Med*. 29, 2030–2040 (2023). [doi:10.1038/s41591-023-02463-9](https://doi.org/10.1038/s41591-023-02463-9)

Salegio E, Hancock K, Korszen S. **Pre-Clinical Delivery of Gene Therapy Products into the Cerebrospinal Fluid: Challenges and Considerations for Clinical Translation.** *Front. Mol. Neurosci. Sec. Brain Disease Mechanisms*. Vol. 16 – 2023. [doi:10.3389/fnmol.2023.1248271](https://doi.org/10.3389/fnmol.2023.1248271)

Cruz-Garza JG, Taghlabi KM, Bhenderu LS, Gupta S, et al. **Magnetic Resonance-Guided Stereotaxy for Infusions to the Pig Brain.** *JoVE Journal Neuroscience*. Published online: 31 March 2023. [doi:10.3791/64079-v](https://doi.org/10.3791/64079-v)

Compton DR, DeMarco SJ, Yalamanchili P. **AAV2-hAADC (Eladocogene Exuparvovec) Biodistribution and Expression: Superiority of Intraputaminial versus Intracerebroventricular and Intrathecal (Lumbar) Routes of Administration.** *International Journal of Toxicology*. 2023;42(2):135-145. [doi:10.1177/10915818221144424](https://doi.org/10.1177/10915818221144424)

Compton DR, DeMarco SJ, Yalamanchili P. **Supplemental Material – AAV2-hAADC (Eladocogene Exuparvovec) Biodistribution and Expression: Superiority of Intraputaminial versus Intracerebroventricular and Intrathecal (Lumbar) Routes of Administration.** *SAGE Journals*. Journal contribution posted 2022-12-06. doi.org/10.25384/SAGE.21685655.v1

Keam SJ. **Eladocogene Exuparvovec: First Approval.** *Drugs* (2022). Published online: 14 September 2022. [doi:10.1007/s40265-022-01775-3](https://doi.org/10.1007/s40265-022-01775-3)

Salegio EA, Cukrov M, Lortz R, Green A, et al. **Feasibility of Targeted Delivery of AAV5-GFP into the Cerebellum of Nonhuman Primates Following a Single Convection-Enhanced Delivery Infusion.** *Human Gene Therapy*. 2022;3: Epub ahead of print. [doi:10.1089/hum.2021.163](https://doi.org/10.1089/hum.2021.163)

Keiser MS, Ranum PT, Yrigollen CM, Carrell EM, et al. **Toxicity after AAV delivery of RNAi expression constructs into nonhuman primate brain.** *Nature Medicine*. 2021;27:1982-1989. [doi:10.1038/s41591-021-01522-3](https://doi.org/10.1038/s41591-021-01522-3)

- Pearson TS, Gupta N, Sebastian WS, Imamura-Ching J, et al. **Gene therapy for aromatic L-amino acid decarboxylase deficiency by MR-guided direct delivery of AAV2-AADC to midbrain dopaminergic neurons.** *Nature Communications*. 2021;12, 4251. [doi:10.1038/s41467-021-24524-8](https://doi.org/10.1038/s41467-021-24524-8)
- Rossmeis JH, Herpai D, Quigley M, Cecere TE, et al. **Phase I trial of convection-enhanced delivery of IL13RA2 and EPHA2 receptor targeted cytotoxins in dogs with spontaneous intracranial gliomas.** *Neuro-Oncology*. 2021;23(3):422-434. [doi:10.1093/neuonc/noaa196](https://doi.org/10.1093/neuonc/noaa196)
- Bander ED, Ramos AD, Wembacher-Schroder E, Ivasky I, et al. **Repeat convection-enhanced delivery for diffuse intrinsic pontine glioma.** *Journal of Neurosurgery*. 2020;26(6):661-667. [doi:10.3171/2020.6.PEDS20280](https://doi.org/10.3171/2020.6.PEDS20280)
- Buttery PC, Barker RA. **Gene and cell-based therapies for Parkinson's disease: Where are we?** *Neurotherapeutics*. 2020;17:1539-1562. [doi:10.1007/s13311-020-00940-4](https://doi.org/10.1007/s13311-020-00940-4)
- Taghian T, Horn E, Shazeeb MS, Bierfeldt LJ, et al. **Volume and infusion rate dynamics of intraparenchymal central nervous system infusion in a large animal model.** *Human Gene Therapy*. 2020;31(11-12):617-625. [doi:10.1089/hum.2019.288](https://doi.org/10.1089/hum.2019.288)
- Nutt JG, Curtze C, Hiller A, Anderson S, et al. **Aromatic L-Amino acid decarboxylase gene therapy enhances levodopa response in Parkinson's disease.** *Movement Disorders*. 2020;35(5):851-858. [doi:10.1002/mds.27993](https://doi.org/10.1002/mds.27993)
- Richardson MR, Bankiewicz KS, Chadwick CW, Van Laar AD, et al. **Data-driven evolution of neurosurgical gene therapy delivery in Parkinson's disease.** *Journal of Neurology, Neurosurgery, & Psychiatry*. 2020. [doi:10.1136/jnnp-2020-322904](https://doi.org/10.1136/jnnp-2020-322904)
- Souweidane MM, Tosi U. **Convection enhanced delivery for diffuse intrinsic pontine glioma: Review of a single institution experience.** *Pharmaceutics*. 2020;12(660). [doi:10.3390/pharmaceutics12070660](https://doi.org/10.3390/pharmaceutics12070660)
- Chadwick CW, Bankiewicz KS, Van Laar AD, Richardson MR, et al. **Magnetic resonance imaging-guided phase 1 trial of putaminal AADC gene therapy for Parkinson's disease.** *Annals of Neurology*. 2019;85:704–714. [doi:10.1002/ana.25450](https://doi.org/10.1002/ana.25450)
- Salegio EA, Campagna MV, Allen PC, Stockinger DE, Song Y, Hwa GC. **Targeted delivery and tolerability of MRI-guided CED infusion into the cerebellum of nonhuman primates.** *Human Gene Therapy Methods*. 2018;29(4). [doi:10.1089/hgtb.2018.049](https://doi.org/10.1089/hgtb.2018.049)
- Talbott JF, Cooke DL, Mabray MC, Larson PS, et al. **Accuracy of image-guided percutaneous injection into a phantom spinal cord utilizing flat panel detector CT with MR fusion and integrated navigational software.** *Journal of NeuroInterventional Surgery*. 2018;10(12). [doi:10.1136/neurintsurg-2018-013878](https://doi.org/10.1136/neurintsurg-2018-013878)
- Jahangiri A, Chin AT, Flanigan PM, Chen R, Bankiewicz KS, Aghi MK. **Convection-enhanced delivery in glioblastoma: a review of preclinical and clinical studies.** *Journal of Neurosurgery*. 2017;126(1):191–200. [doi:10.3171/2016.1.JNS151591](https://doi.org/10.3171/2016.1.JNS151591)
- Vasconcellos E, Wembacher-Schroder E, Thomson R, Rube M, Souweidane M. **A flexible step design infusion catheter for prolonged drug delivery into the brain stem of children.** *Neuro-Oncology*. 2016;18(3):iii128. [doi:10.1093/neuonc/now078.08](https://doi.org/10.1093/neuonc/now078.08)

*Han SJ, Bankiewicz K, Butowski NA, Larson PS, Aghi MK. **Interventional MRI-guided catheter placement and real time drug delivery to the central nervous system.** *Expert Review of Neurotherapeutics*. 2016;16(6):635–639. [doi:10.1080/14737175.2016.1175939](https://doi.org/10.1080/14737175.2016.1175939)

Rowland NC, Kalia SK, Kalia LV, Larson PS, et al. **Merging DBS with viral vector or stem cell implantation: "Hybrid" stereotactic surgery as an evolution in the surgical treatment of Parkinson's disease.** *Molecular Therapy Methods & Clinical Development*. 2016;3:15051. [doi:10.1038/mtm.2015.51](https://doi.org/10.1038/mtm.2015.51)

Vogelbaum MA & Aghi MK. **Convection-enhanced delivery for the treatment of glioblastoma.** *Neuro-Oncology*. 2015;7(2):ii3-ii8. [doi:10.1093/neuonc/nou354](https://doi.org/10.1093/neuonc/nou354)

Chittiboina P, Heiss JD, Lonser RR. **Accuracy of direct magnetic resonance imaging-guided placement of drug infusion cannulae.** *Journal of Neurosurgery*. 2015;122(5):1173–1179. [doi:10.3171/2014.11.JNS131888](https://doi.org/10.3171/2014.11.JNS131888)

Silvestrini MT, Yin D, Martin AJ, Coppes VG, et al. **Interventional magnetic resonance imaging-guided cell transplantation into the brain with radially branched deployment.** *Molecular Therapy Methods & Clinical Development*. 2015;23(1):119–129. [doi:10.1038/mt.2014.155](https://doi.org/10.1038/mt.2014.155)

Richardson MR, Kells AP, Martin AJ, Larson PS, et al. **Novel platform for MRI-guided convection-enhanced delivery of therapeutics: preclinical validation in nonhuman primate brain.** *Stereotactic and Functional Neurosurgery*. 2011;89(3):141–151. [doi:10.1159/000323544](https://doi.org/10.1159/000323544)

Richardson MR, Kells AP, Rosenbluth KH, Salegio EA, et al. **Interventional MRI-guided putaminal delivery of AAV2-GDNF for a planned clinical trial in Parkinson's disease.** *Molecular Therapy*. 2011;19(6):1048–1057. [doi:10.1038/mt.2011.11](https://doi.org/10.1038/mt.2011.11)

*The ClearPoint Navigation System enables intraprocedural MRI guidance for a number of neurological therapies and approved clinical trials.

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