

# Cochlear implantation

Cochlear implants provide an effective treatment option for those with severe hearing loss, including those with preserved low frequency hearing.

Common contraindication to [MRI](#).

Hearing rehabilitation is an important management aspect of patients undergoing excision of vestibular schwannomas. Studies have shown cochlear implantation (CI) is possible at the time of tumor excision via a translabyrinthine approach. Primary objectives of this report are (1) to review prospective studies pertaining to outcomes of concurrent CI and translabyrinthine tumor removal in detail and (2) perform an aggregate analysis of outcomes for case reports and series. Design

Systematic review based on Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Setting Review of literature using PubMed and Cochrane databases. Participants Eligibility included patients undergoing translabyrinthine excision of vestibular schwannoma with concurrent CI. Main Outcome Measures Open-set speech discrimination scores, sound localization, patient-reported outcome measures. Results Forty-one subjects were identified. Two prospective studies have been performed, which showed improvement in speech localization and patient-reported outcome measures. While the majority of patients achieved open set speech recognition, data pertaining to improvement in speech perception were variable. Approximately 85% of subjects had audibility with their CI. Of those that achieved open-set speech discrimination, 75% could be classified as either intermediate or high performers. The majority of low performers in open-set speech either endorsed subjective benefit or demonstrated improvement compared to preoperative measures. There was a high risk of selection and reporting bias. Conclusions The majority of patients undergoing translabyrinthine excision of vestibular schwannoma with concurrent CI achieve open set speech perception, with 75% of these patients meeting criteria for being intermediate to high performers. Additional benefits include improved subjective hearing measures, decreased tinnitus, and improved sound localization <sup>1)</sup>.

## Technique

[Cochlear implantation technique](#).

## Mouse model of cochlear implantation

see [Mouse model of cochlear implantation](#).

## Unclassified

2: Manekar G, Arriaga MA, Viator D, Volk JM. Cochlear implantation via middle fossa approach - a case report. *Cochlear Implants Int.* 2019 Feb 11:1-6. doi: 10.1080/14670100.2019.1578470. [Epub ahead of print] PubMed PMID: 30741118.

3: Mei X, Schart-Morén N, Li H, Ladak HM, Agrawal S, Behr R, Rask-Andersen H. Three-dimensional

imaging of the human internal acoustic canal and arachnoid cistern: a synchrotron study with clinical implications. *J Anat.* 2019 Mar;234(3):316-326. doi: 10.1111/joa.12926. Epub 2018 Dec 18. PubMed PMID: 30565214; PubMed Central PMCID: PMC6365480.

4: Zhang X, Weng Y, Liang M, Liu J, Chen Y, Zheng Y. Auditory and speech function after cochlear implantation in prelingually deaf children with white matter lesions. *Dev Med Child Neurol.* 2018 Dec 16. doi: 10.1111/dmcn.14128. [Epub ahead of print] PubMed PMID: 30556123.

5: Svrakic M, Golfinos JG, Zagzag D, Roland JT Jr. Cochlear Implantation of a Patient with Definitive Neurosarcoidosis. *OTO Open.* 2017 Nov 15;1(4):2473974x17742633. doi: 10.1177/2473974x17742633. eCollection 2017 Oct-Dec. PubMed PMID: 30480198; PubMed Central PMCID: PMC6239151.

6: Coenen VA, Rijntjes M, Sajonz B, Piroth T, Prokop T, Jost W, Trippel M, Urbach H, Reinacher PC. Bilateral Globus Pallidus Internus Deep Brain Stimulation in a Case of Progressive Dystonia in Mohr-Tranebaerg Syndrome with Bilateral Cochlear Implants. *J Neurol Surg A Cent Eur Neurosurg.* 2019 Jan;80(1):44-48. doi: 10.1055/s-0038-1669472. Epub 2018 Oct 5. PubMed PMID: 30290379.

7: Tyler RS, Owen RL, Bridges J, Gander PE, Perreau A, Mancini PC. Tinnitus Suppression in Cochlear Implant Patients Using a Sound Therapy App. *Am J Audiol.* 2018 Sep 12;27(3):316-323. doi: 10.1044/2018\_AJA-17-0105. PubMed PMID: 30105356.

8: Ehrmann-Müller D, Kühn H, Matthies C, Hagen R, Shehata-Dieler W. Outcomes after cochlear implant provision in children with cochlear nerve hypoplasia or aplasia. *Int J Pediatr Otorhinolaryngol.* 2018 Sep;112:132-140. doi: 10.1016/j.ijporl.2018.06.038. Epub 2018 Jun 23. PubMed PMID: 30055722.

9: Moteki H, Fujinaga Y, Goto T, Usami SI. Pneumolabyrinth, intracochlear and vestibular fluid loss after cochlear implantation. *Auris Nasus Larynx.* 2018 Oct;45(5):1116-1120. doi: 10.1016/j.anl.2018.03.004. Epub 2018 Apr 19. PubMed PMID: 29680680.

10: Malerbi AFDS, Goffi-Gomez MVS, Tsuji RK, Gomes MQT, Brito Neto R, Bento RF. Auditory brainstem implant in postmeningitis totally ossified cochleae. *Acta Otolaryngol.* 2018 Aug;138(8):722-726. doi: 10.1080/00016489.2018.1449964. Epub 2018 Apr 1. PubMed PMID: 29607748.

11: Smit JV, Pielkenrood BJ, Arts RAGJ, Janssen ML, Temel Y, Stokroos RJ. Patient Acceptance of Invasive Treatments for Tinnitus. *Am J Audiol.* 2018 Jun 8;27(2):184-196. doi: 10.1044/2017\_AJA-17-0015. PubMed PMID: 29507954.

12: Dos Santos Neto PH, Zamponi JO, Hamerschmidt R, Wiemes GRM, Rassi MS, Borba LAB. Simultaneous cochlear implantation as a therapeutic option in vestibular schwannoma surgery: case report. *Neurosurg Focus.* 2018 Mar;44(3):E9. doi: 10.3171/2017.12.FOCUS17670. PubMed PMID: 29490548.

13: Song JJ, Kim K, Sunwoo W, Mertens G, de Heyning PV, Ridder D, Vanneste S, Lee SY, Park KJ, Choi H, Choi JW. Corrigendum: A Quantitative Electroencephalography Study on Cochlear Implant-Induced Cortical Changes in Single-Sided Deafness with Tinnitus. *Front Hum Neurosci.* 2018 Feb 20;12:46. doi: 10.3389/fnhum.2018.00046. eCollection 2018. PubMed PMID: 29487513; PubMed Central PMCID: PMC5826261.

14: Zhou Q, Yang Z, Wang Z, Wang B, Wang X, Zhao C, Zhang S, Wu T, Li P, Li S, Zhao F, Liu P. Awake craniotomy for assisting placement of auditory brainstem implant in NF2 patients. *Acta Otolaryngol.* 2018 Jun;138(6):548-553. doi: 10.1080/00016489.2018.1424998. Epub 2018 Jan 23. PubMed PMID:

29361882.

- 15: Vashishth A, Fulcheri A, Prasad SC, Dandinarasaiah M, Caruso A, Sanna M. Cochlear Implantation in Chronic Otitis Media With Cholesteatoma and Open Cavities: Long-term Surgical Outcomes. *Otol Neurotol*. 2018 Jan;39(1):45-53. doi: 10.1097/MAO.0000000000001624. PubMed PMID: 29227448.
- 16: Roetzer KM, Uyanik G, Brehm A, Zwerina J, Zandieh S, Czech T, Roschger P, Misof BM, Klaushofer K. Novel familial mutation of LRP5 causing high bone mass: Genetic analysis, clinical presentation, and characterization of bone matrix mineralization. *Bone*. 2018 Feb;107:154-160. doi: 10.1016/j.bone.2017.12.002. Epub 2017 Dec 5. PubMed PMID: 29208525.
- 17: Altuna X, García L, Martínez Z, de Pinedo MF. The role of subtotal petrosectomy in cochlear implant recipients. *Eur Arch Otorhinolaryngol*. 2017 Dec;274(12):4149-4153. doi: 10.1007/s00405-017-4762-x. Epub 2017 Oct 16. PubMed PMID: 29038860.
- 18: Plontke SK, Rahne T, Pfister M, Götze G, Heider C, Pazaitis N, Strauss C, Caye-Thomassen P, Köslin S. Intralabyrinthine schwannomas : Surgical management and hearing rehabilitation with cochlear implants. *HNO*. 2017 Aug;65(Suppl 2):136-148. doi: 10.1007/s00106-017-0364-6. PubMed PMID: 28664238; PubMed Central PMCID: PMC5554299.
- 19: DeHart AN, Broaddus WC, Coelho DH. Translabyrinthine vestibular schwannoma resection with simultaneous cochlear implantation. *Cochlear Implants Int*. 2017 Sep;18(5):278-284. doi: 10.1080/14670100.2017.1337665. Epub 2017 Jun 12. Review. PubMed PMID: 28602150.
- 20: Song JJ, Kim K, Sunwoo W, Mertens G, Van de Heyning P, De Ridder D, Vanneste S, Lee SY, Park KJ, Choi H, Choi JW. A Quantitative Electroencephalography Study on Cochlear Implant-Induced Cortical Changes in Single-Sided Deafness with Tinnitus. *Front Hum Neurosci*. 2017 May 18;11:210. doi: 10.3389/fnhum.2017.00210. eCollection 2017. Erratum in: *Front Hum Neurosci*. 2018 Feb 20;12 :46. PubMed PMID: 28572760; PubMed Central PMCID: PMC5435818.
- 21: Volkenstein S, Dazert S. [Recent surgical options for vestibular vertigo]. *Laryngorhinootologie*. 2017 Apr;96(S 01):S209-S229. doi: 10.1055/s-0042-120050. Epub 2017 May 12. Review. German. PubMed PMID: 28499300.
- 22: Goyal S, Krishnan SS, Kameswaran M, Vasudevan MC, Ranjith, Natarajan K. Does cerebellar flocculus size affect subjective outcomes in pediatric auditory brainstem implantation. *Int J Pediatr Otorhinolaryngol*. 2017 Jun;97:30-34. doi: 10.1016/j.ijporl.2017.03.027. Epub 2017 Mar 22. PubMed PMID: 28483247.
- 23: Eddelman D, Wewel J, Wiet RM, Metman LV, Sani S. Deep brain stimulation with a pre-existing cochlear implant: Surgical technique and outcome. *Surg Neurol Int*. 2017 Apr 5;8:47. doi: 10.4103/sni.sni\_412\_16. eCollection 2017. PubMed PMID: 28480109; PubMed Central PMCID: PMC5402338.
- 24: Plontke SK, Rahne T, Pfister M, Götze G, Heider C, Pazaitis N, Strauss C, Caye-Thomassen P, Köslin S. [Intralabyrinthine schwannomas : Surgical management and hearing rehabilitation with cochlear implants. German version]. *HNO*. 2017 May;65(5):419-433. doi: 10.1007/s00106-017-0361-9. German. PubMed PMID: 28421258.
- 25: Zhang XY, Liang MJ, Liu JH, Li XH, Zhen YQ, Weng YL. [The effect of white matter abnormality to auditory and speech rehabilitation after cochlear implantation in prelingual deafness children]. *Lin Chung Er Bi Yan Hou Jing Wai Ke Za Zhi*. 2017 Apr 20;31(8):592-597. doi: 10.13201/j.issn.1001-1781.2017.08.005. Chinese. PubMed PMID: 29871321.

- 26: Lloyd SKW, King AT, Rutherford SA, Hammerbeck-Ward CL, Freeman SRM, Mawman DJ, O'Driscoll M, Evans DG. Hearing optimisation in neurofibromatosis type 2: A systematic review. *Clin Otolaryngol*. 2017 Dec;42(6):1329-1337. doi: 10.1111/coa.12882. Epub 2017 Apr 26. Review. PubMed PMID: 28371358.
- 27: Colletti G, Mandalà M, Colletti V, Deganello A, Allevi F, Colletti L. Resorbable Mesh Cranioplasty Repair of Bilateral Cerebrospinal Fluid Leaks Following Pediatric Simultaneous Bilateral Auditory Brainstem Implant Surgery. *Otol Neurotol*. 2017 Apr;38(4):606-609. doi: 10.1097/MAO.0000000000001338. PubMed PMID: 28121970.
- 28: Fisher LM, Martinez AS, Richmond FJ, Krieger MD, Wilkinson EP, Eisenberg LS. Assessing the Benefit-Risk Profile for Pediatric Implantable Auditory Prostheses. *Ther Innov Regul Sci*. 2018 Sep;52(5):669-679. doi: 10.1177/2168479017741111. Epub 2017 Nov 29. PubMed PMID: 29714549; PubMed Central PMCID: PMC5943182.
- 29: Lin JP, Kaminska M, Perides S, Gimeno H, Baker L, Lumsden DE, Britz A, Driver S, Fitzgerald-O'Connor A, Selway R. Bilateral globus pallidus internus deep brain stimulation for dyskinetic cerebral palsy supports success of cochlear implantation in a 5-year old ex-24 week preterm twin with absent cerebellar hemispheres. *Eur J Paediatr Neurol*. 2017 Jan;21(1):202-213. doi: 10.1016/j.ejpn.2016.11.017. Epub 2016 Dec 10. PubMed PMID: 28017556.
- 30: van den Berge MJ, van Dijk JM, Free RH, Stienstra J, van Dijk P, van der Laan BF. Effect of Direct Stimulation of the Cochleovestibular Nerve on Tinnitus: A Long-Term Follow-Up Study. *World Neurosurg*. 2017 Feb;98:571-577. doi: 10.1016/j.wneu.2016.11.036. Epub 2016 Nov 17. PubMed PMID: 27867121.
- 31: Canzi P, Manfrin M, Perotti M, Aprile F, Quaglieri S, Rebecchi E, Locatelli G, Benazzo M. Translabyrinthine vestibular neurectomy and simultaneous cochlear implant for Ménière's disease. *Acta Neurochir (Wien)*. 2017 Jan;159(1):123-130. doi: 10.1007/s00701-016-2996-9. Epub 2016 Nov 4. PubMed PMID: 27812817.
- 32: He S, McFayden TC, Teagle HF, Ewend M, Henderson L, Buchman CA. Electrically Evoked Auditory Event-Related Responses in Patients with Auditory Brainstem Implants: Morphological Characteristics, Test-Retest Reliability, Effects of Stimulation Level, and Association with Auditory Detection. *Ear Hear*. 2016 Nov/Dec;37(6):634-649. PubMed PMID: 27579988; PubMed Central PMCID: PMC5079768.
- 33: Früh A, Siem G, Holmström H, Døhlen G, Haugaa KH. The Jervell and Lange-Nielsen syndrome; atrial pacing combined with β-blocker therapy, a favorable approach in young high-risk patients with long QT syndrome? *Heart Rhythm*. 2016 Nov;13(11):2186-2192. doi: 10.1016/j.hrthm.2016.07.020. Epub 2016 Jul 20. PubMed PMID: 27451284.
- 34: Schwartz MS, Wilkinson EP. Auditory brainstem implant program development. *Laryngoscope*. 2017 Aug;127(8):1909-1915. doi: 10.1002/lary.26312. Epub 2016 Sep 26. Review. PubMed PMID: 27716925.
- 35: Bonne N-, Aboukais R, Baroncini M, Hochart A, Leblond P, Broly F, Dubrulle F, Lejeune JP, Vincent C. Pediatric neurofibromatosis type 2: clinical and molecular presentation, management of vestibular schwannomas, and hearing rehabilitation. *Childs Nerv Syst*. 2016 Dec;32(12):2403-2413. Epub 2016 Oct 4. PubMed PMID: 27704245.
- 36: North HJ, Mawman D, O'Driscoll M, Freeman SR, Rutherford SA, King AT, Hammerbeck-Ward C, Evans DG, Lloyd SK. Outcomes of cochlear implantation in patients with neurofibromatosis type 2. *Cochlear Implants Int*. 2016 Jul;17(4):172-177. PubMed PMID: 27691934.

- 37: Hudson VE, Elniel A, Ughratdar I, Zebian B, Selway R, Lin JP. A comparative historical and demographic study of the neuromodulation management techniques of deep brain stimulation for dystonia and cochlear implantation for sensorineural deafness in children. *Eur J Paediatr Neurol.* 2017 Jan;21(1):122-135. doi: 10.1016/j.ejpn.2016.07.018. Epub 2016 Aug 3. PubMed PMID: 27562095.
- 38: Rotter N, Schmitz B, Sommer F, Röhrer S, Schuler PJ, Bischof F, Scheithauer MO, Hoffmann TK. First use of flat-panel computed tomography during cochlear implant surgery : Perspectives for the use of advanced therapies in cochlear implantation. *HNO.* 2017 Jan;65(1):61-65. doi: 10.1007/s00106-016-0213-z. PubMed PMID: 27534759.
- 39: Ramsden RT, Freeman SR, Lloyd SK, King AT, Shi X, Ward CL, Huson SM, Mawman DJ, O'Driscoll MP, Evans DG, Rutherford SA; Manchester Neurofibromatosis Type 2 Service. Auditory Brainstem Implantation in Neurofibromatosis Type 2: Experience From the Manchester Programme. *Otol Neurotol.* 2016 Oct;37(9):1267-74. doi: 10.1097/MAO.0000000000001166. PubMed PMID: 27525707.
- 40: Nakatomi H, Miyawaki S, Kin T, Saito N. Hearing Restoration with Auditory Brainstem Implant. *Neurol Med Chir (Tokyo).* 2016 Oct 15;56(10):597-604. Epub 2016 Jul 26. Review. PubMed PMID: 27464470; PubMed Central PMCID: PMC5066080.
- 41: Sennaroğlu L, Colletti V, Lenarz T, Manrique M, Laszig R, Rask-Andersen H, Göksu N, Offeciers E, Saeed S, Behr R, Bayazıt Y, Casselman J, Freeman S, Kileny P, Lee DJ, Shannon RV, Kameswaran M, Hagr A, Zarowski A, Schwartz MS, Bilginer B, Kishore A, Sennaroğlu G, Yücel E, Saraç S, Ataş A, Colletti L, O'Driscoll M, Moon IS, Gärtner L, Huarte A, Nyberg G, Mocan BÖ, Atay G, Bajin MD, Çınar BÇ, Batuk MÖ, Yaralı M, Aydınlı FE, Aslan F, Kirazlı MC, Özkan HB, Hans JM, Kosaner J, Polak M. Consensus statement: Long-term results of ABI in children with complex inner ear malformations and decision making between CI and ABI. *Cochlear Implants Int.* 2016 Jul;17(4):163-171. Epub 2016 Jul 21. PubMed PMID: 27442073.
- 42: Cosetti MK, Pinkston JB, Flores JM, Friedmann DR, Jones CB, Roland JT Jr, Waltzman SB. Neurocognitive testing and cochlear implantation: insights into performance in older adults. *Clin Interv Aging.* 2016 May 12;11:603-13. doi: 10.2147/CIA.S100255. eCollection 2016. PubMed PMID: 27274210; PubMed Central PMCID: PMC4869653.
- 43: Sennaroğlu L, Sennaroğlu G, Yücel E, Bilginer B, Atay G, Bajin MD, Mocan BÖ, Yaral M, Aslan F, Çınar BÇ, Özkan B, Batuk MÖ, Kirazlı ÇE, Karakaya J, Ataş A, Saraç S, Ziyal İ. Long-term Results of ABI in Children With Severe Inner Ear Malformations. *Otol Neurotol.* 2016 Aug;37(7):865-72. doi: 10.1097/MAO.0000000000001050. PubMed PMID: 27273392.
- 44: Lee JM, Chang JW, Choi JY, Chang WS, Moon IS. Hearing Restoration in Neurofibromatosis Type II Patients. *Yonsei Med J.* 2016 Jul;57(4):817-23. doi: 10.3349/ymj.2016.57.4.817. Review. PubMed PMID: 27189272; PubMed Central PMCID: PMC4951455.
- 45: Puram SV, Barber SR, Kozin ED, Shah P, Remenschneider A, Herrmann BS, Duhaime AC, Barker FG 2nd, Lee DJ. Outcomes following Pediatric Auditory Brainstem Implant Surgery: Early Experiences in a North American Center. *Otolaryngol Head Neck Surg.* 2016 Jul;155(1):133-8. doi: 10.1177/0194599816637599. Epub 2016 Apr 19. PubMed PMID: 27095049.
- 46: Puram SV, Herrmann B, Barker FG 2nd, Lee DJ. Retrosigmoid Craniotomy for Auditory Brainstem Implantation in Adult Patients with Neurofibromatosis Type 2. *J Neurol Surg B Skull Base.* 2015 Dec;76(6):440-50. doi: 10.1055/s-0034-1544121. Epub 2015 Jun 12. PubMed PMID: 27054058; PubMed Central PMCID: PMC4813683.
- 47: Kalakoti P, Murray RD, Pettersson-Segerlind J, Smeds H, Nanda A. Cochlear implants in the

etiopathogenesis of glioblastoma—an interesting observation or independent finding? *Acta Neurochir (Wien)*. 2016 May;158(5):907-12. doi: 10.1007/s00701-016-2718-3. Epub 2016 Feb 9. PubMed PMID: 26858207.

48: Lloyd SK, Evans DG. Neurofibromatosis type 2 service delivery in England. *Neurochirurgie*. 2018 Nov;64(5):375-380. doi: 10.1016/j.neuchi.2015.10.006. Epub 2016 Jan 27. PubMed PMID: 26826883.

49: Barber SR, Remenschneider AK, Kozin ED, Cunnane ME, Nahed BV, Leslie-Mazwi T, Quesnel AM. Cochlear Implantation in a Patient With Pfeiffer Syndrome and Temporal Bone Vascular Anomalies. *Otol Neurotol*. 2016 Mar;37(3):241-3. doi: 10.1097/MAO.0000000000000965. PubMed PMID: 26825670.

50: Olds C, Pollonini L, Abaya H, Larky J, Loy M, Bortfeld H, Beauchamp MS, Oghalai JS. Cortical Activation Patterns Correlate with Speech Understanding After Cochlear Implantation. *Ear Hear*. 2016 May-Jun;37(3):e160-72. doi: 10.1097/AUD.0000000000000258. PubMed PMID: 26709749; PubMed Central PMCID: PMC4844823.

51: Rosahl SK, Rosahl S. Letter: Anatomy and Auditory Brainstem Implants. *Neurosurgery*. 2016 Apr;78(4):E601-2. doi: 10.1227/NEU.0000000000001178. PubMed PMID: 26673540.

52: Roche JP, Hansen MR. On the Horizon: Cochlear Implant Technology. *Otolaryngol Clin North Am*. 2015 Dec;48(6):1097-116. doi: 10.1016/j.otc.2015.07.009. Epub 2015 Oct 9. Review. PubMed PMID: 26443490; PubMed Central PMCID: PMC4641792.

53: Anand V, Devi MK, Kannan T, Chenniappan S. Laser tympanic neurectomy for post-cochlear implant pain: A new technique. *Cochlear Implants Int*. 2016;17(2):105-8. doi: 10.1179/1754762815Y.0000000020. Epub 2016 Feb 2. PubMed PMID: 26252730.

54: Cosetti MK, Friedmann DR, Heman-Ackah SE, Perez R, Waltzman SB, Roland JT Jr. Surgical techniques and outcomes of cochlear implantation in patients with radiographic findings consistent with X-linked deafness. *Int J Pediatr Otorhinolaryngol*. 2015 Oct;79(10):1689-93. doi: 10.1016/j.ijporl.2015.07.027. Epub 2015 Jul 28. PubMed PMID: 26250436.

55: Kopelovich JC, Robinson BK, Soken H, Verhoeven KJ, Kirk JR, Goodman SS, Hansen MR. Acoustic Hearing After Murine Cochlear Implantation: Effects of Trauma and Implant Type. *Ann Otol Rhinol Laryngol*. 2015 Dec;124(12):931-9. doi: 10.1177/0003489415592162. Epub 2015 Jun 19. PubMed PMID: 26091845.

56: Buell TJ, Ksendzovsky A, Shah BB, Kesser BW, Elias WJ. Deep Brain Stimulation in the Setting of Cochlear Implants: Case Report and Literature Review. *Stereotact Funct Neurosurg*. 2015;93(4):245-9. doi: 10.1159/000380824. Epub 2015 May 21. Review. PubMed PMID: 25998722; PubMed Central PMCID: PMC4540667.

57: Batuecas-Caletrio A, Klumpp M, Santacruz-Ruiz S, Benito Gonzalez F, Gonzalez Sánchez E, Arriaga M. Vestibular function in cochlear implantation: Correlating objectiveness and subjectiveness. *Laryngoscope*. 2015 Oct;125(10):2371-5. doi: 10.1002/lary.25299. Epub 2015 Apr 17. PubMed PMID: 25891786.

58: Komune N, Yagmurlu K, Matsuo S, Miki K, Abe H, Rhoton AL Jr. Auditory brainstem implantation: anatomy and approaches. *Neurosurgery*. 2015 Jun;11 Suppl 2:306-20; discussion 320-1. doi: 10.1227/NEU.0000000000000736. PubMed PMID: 25793729.

59: Kobler JP, Wall S, Lexow GJ, Lang CP, Majdani O, Kahrs LA, Ortmaier T. An experimental evaluation

- of loads occurring during guided drilling for cochlear implantation. *Int J Comput Assist Radiol Surg.* 2015 Oct;10(10):1625-37. doi: 10.1007/s11548-015-1153-x. Epub 2015 Feb 12. PubMed PMID: 25673073.
- 60: Puram SV, Tward AD, Jung DH, Dilger AE, Herrmann BS, Duhaime AC, Barker FG 2nd, Lee DJ. Auditory brainstem implantation in a 16-month-old boy with cochlear hypoplasia. *Otol Neurotol.* 2015 Apr;36(4):618-24. doi: 10.1097/MAO.0000000000000676. PubMed PMID: 25473959.
- 61: Song JJ, Mertens G, Deleye S, Staelens S, Ceyssens S, Gilles A, de Bodt M, Vanneste S, De Ridder D, Kim E, Park SJ, Van de Heyning P. Neural substrates of conversion deafness in a cochlear implant patient: a molecular imaging study using H<sub>2</sub><sup>15</sup>O-PET. *Otol Neurotol.* 2014 Dec;35(10):1780-4. doi: 10.1097/MAO.0000000000000560. PubMed PMID: 25166017.
- 62: Ozdek A, Bayır O, Dönmez T, Ozişik P, Sahin M, Tulgar M, Tatar EÇ, Korkmaz MH. Hearing restoration in NF2 patients and patients with vestibular schwannoma in the only hearing ear: report of two cases. *Am J Otolaryngol.* 2014 Jul-Aug;35(4):538-41. doi: 10.1016/j.amjoto.2014.03.014. Epub 2014 Mar 26. PubMed PMID: 24746329.
- 63: Baidya NB, Berhouma M, Ammirati M. Endoscope-assisted retrosigmoid resection of a medium size vestibular schwannoma tumor model: a cadaveric study. *Clin Neurol Neurosurg.* 2014 Apr;119:35-8. doi: 10.1016/j.clineuro.2013.12.023. Epub 2014 Jan 18. PubMed PMID: 24635922.
- 64: Walton J, Donnelly NP, Tam YC, Joubert I, Durie-Gair J, Jackson C, Mannion RA, Tysome JR, Axon PR, Scoffings DJ. MRI without magnet removal in neurofibromatosis type 2 patients with cochlear and auditory brainstem implants. *Otol Neurotol.* 2014 Jun;35(5):821-5. doi: 10.1097/MAO.0000000000000330. PubMed PMID: 24608375.
- 65: Backous DD. Cochlear implant placement: round window approach. *Neurosurg Focus.* 2014 Jan;36(1 Suppl):1. doi: 10.3171/2014.V1.FOCUS13537. PubMed PMID: 24380531.
- 66: Lloyd SK, Glynn FJ, Rutherford SA, King AT, Mawman DJ, O'Driscoll MP, Evans DG, Ramsden RT, Freeman SR. Ipsilateral cochlear implantation after cochlear nerve preserving vestibular schwannoma surgery in patients with neurofibromatosis type 2. *Otol Neurotol.* 2014 Jan;35(1):43-51. doi: 10.1097/MAO.0000000000000185. PubMed PMID: 24335931.
- 67: Mallory GW, Pollock BE, Foote RL, Carlson ML, Driscoll CL, Link MJ. Stereotactic radiosurgery for neurofibromatosis 2-associated vestibular schwannomas: toward dose optimization for tumor control and functional outcomes. *Neurosurgery.* 2014 Mar;74(3):292-300; discussion 300-1. doi: 10.1227/NEU.000000000000264. PubMed PMID: 24335819.
- 68: Chadwick KA, Moore J, Tye GW, Coelho DH. Management of patients with cochlear implants and ventriculoperitoneal shunts. *Cochlear Implants Int.* 2014 Jul;15(4):185-90. doi: 10.1179/1754762813Y.0000000055. Epub 2013 Nov 25. Review. PubMed PMID: 24144174.
- 69: Tysome JR, Axon PR, Donnelly NP, Evans DG, Ferner RE, O'Connor AF, Freeman SR, Gleeson M, Halliday D, Harris F, Jiang D, Kerr R, King A, Knight RD, Lloyd SK, Macfarlane R, Mannion R, Mawman D, O'Driscoll M, Parry A, Ramsden J, Ramsden R, Rutherford SA, Saeed SR, Thomas N, Vanat ZH. English consensus protocol evaluating candidacy for auditory brainstem and cochlear implantation in neurofibromatosis type 2. *Otol Neurotol.* 2013 Dec;34(9):1743-7. doi: 10.1097/MAO.0b013e3182a1a8b4. PubMed PMID: 24136318.
- 70: Gürbüz MS, Orakdögen M, Berkman MZ, Yüksel MO. Subdural haematoma as a rare complication of cochlear implantation: case report and literature review. *J Laryngol Otol.* 2013 Aug;127(8):802-4.

- doi: 10.1017/S0022215113001448. Epub 2013 Jul 9. Review. PubMed PMID: 23834762.
- 71: Moffat DA, Lloyd SK, Macfarlane R, Mannion R, King A, Rutherford S, Axon PR, Donnelly N, Freeman S, Tysome JR, Evans DG, Ramsden RT. Outcome of translabyrinthine surgery for vestibular schwannoma in neurofibromatosis type 2. *Br J Neurosurg.* 2013 Aug;27(4):446-53. doi: 10.3109/02688697.2013.771143. Epub 2013 Mar 8. PubMed PMID: 23472624.
- 72: Amoodi HA, Makki FM, Cavanagh J, Maessen H, Bance M. Cochlear implant rehabilitation for patients with vestibular schwannoma: report of two cases. *Cochlear Implants Int.* 2012 May;13(2):124-7. doi: 10.1179/1754762810Y.0000000003. Epub 2011 Jul 11. Review. PubMed PMID: 22152982.
- 73: Merdad M, Crawford M, Gordon K, Papsin B. Unexplained fever after bilateral superficial cervical block in children undergoing cochlear implantation: an observational study. *Can J Anaesth.* 2012 Jan;59(1):28-33. doi: 10.1007/s12630-011-9607-2. Epub 2011 Nov 10. PubMed PMID: 22072060.
- 74: An YH, Song SJ, Yoon SW, Kim JH, Shim HJ. Cochlear implantation for total deafness after ipsilateral ventriculoperitoneal shunt surgery: technical report. *Acta Neurochir (Wien).* 2011 Dec;153(12):2479-83; discussion 2483. doi: 10.1007/s00701-011-1180-5. Epub 2011 Oct 12. PubMed PMID: 21989777.
- 75: De Los Reyes K, Chandrasekhar SS, Tagliati M, Alterman R. Successful implantation of a deep brain stimulator for essential tremor in a patient with a preexisting cochlear implant: surgical technique: technical case report. *Neurosurgery.* 2010 Jun;66(6 Suppl Operative):372; discussion 372. doi: 10.1227/01.NEU.0000369646.01287.42. PubMed PMID: 20489530.
- 76: Skarzynski H, Lorens A, Kochanek K, Mrowka M, Behr R. Bilateral auditory brainstem implantation in a patient with neurofibromatosis type II. *Cochlear Implants Int.* 2010 Jun;11 Suppl 1:88-93. doi: 10.1179/146701010x12671177440226. PubMed PMID: 21756589.
- 77: Labadie RF, Mitchell J, Balachandran R, Fitzpatrick JM. Customized, rapid-production microstereotactic table for surgical targeting: description of concept and in vitro validation. *Int J Comput Assist Radiol Surg.* 2009 May;4(3):273-80. doi: 10.1007/s11548-009-0292-3. Epub 2009 Feb 28. PubMed PMID: 20033593; PubMed Central PMCID: PMC4425254.
- 78: Labadie RF, Balachandran R, Mitchell JE, Noble JH, Majdani O, Haynes DS, Bennett ML, Dawant BM, Fitzpatrick JM. Clinical validation study of percutaneous cochlear access using patient-customized microstereotactic frames. *Otol Neurotol.* 2010 Jan;31(1):94-9. doi: 10.1097/MAO.0b013e3181c2f81a. PubMed PMID: 20019561; PubMed Central PMCID: PMC2845321.
- 79: Ryan JC, Bird PA, Bonkowski JA. Sudden hearing loss following non-petrosus craniotomy. *J Clin Neurosci.* 2010 Jan;17(1):146-9. doi: 10.1016/j.jocn.2009.02.037. Epub 2009 Nov 3. PubMed PMID: 19889544.
- 80: Trotter MI, Briggs RJ. Cochlear implantation in neurofibromatosis type 2 after radiation therapy. *Otol Neurotol.* 2010 Feb;31(2):216-9. doi: 10.1097/MAO.0b013e3181c348e7. PubMed PMID: 19887974.
- 81: Sennaroglu L, Ziyal I, Atas A, Sennaroglu G, Yucel E, Sevinc S, Ekin MC, Sarac S, Atay G, Ozgen B, Ozcan OE, Belgin E, Colletti V, Turan E. Preliminary results of auditory brainstem implantation in prelingually deaf children with inner ear malformations including severe stenosis of the cochlear aperture and aplasia of the cochlear nerve. *Otol Neurotol.* 2009 Sep;30(6):708-15. doi: 10.1097/MAO.0b013e3181b07d41. PubMed PMID: 19704357.

- 82: Wiet RM, El-Kashlan HK. Cochlear implantation in the presence of a programmable ventriculoperitoneal shunt. *Otol Neurotol.* 2009 Sep;30(6):704-7. doi: 10.1097/MAO.0b013e3181b04e3b. PubMed PMID: 19638947.
- 83: Pezaris JS, Eskandar EN. Getting signals into the brain: visual prosthetics through thalamic microstimulation. *Neurosurg Focus.* 2009 Jul;27(1):E6. doi: 10.3171/2009.4.FOCUS0986. Review. PubMed PMID: 19569894; PubMed Central PMCID: PMC2848996.
- 84: Zeitler DM, Budenz CL, Roland JT Jr. Revision cochlear implantation. *Curr Opin Otolaryngol Head Neck Surg.* 2009 Oct;17(5):334-8. doi: 10.1097/MOO.0b013e32832dd6ac. Review. PubMed PMID: 19502980.
- 85: Behr R, Müller J, Shehata-Dieler W, Schlake HP, Helms J, Roosen K, Klug N, Hölder B, Lorens A. The High Rate CIS Auditory Brainstem Implant for Restoration of Hearing in NF-2 Patients. *Skull Base.* 2007 Mar;17(2):91-107. PubMed PMID: 17768439; PubMed Central PMCID: PMC1876152.
- 86: Kuchta J. Twenty-five years of auditory brainstem implants: perspectives. *Acta Neurochir Suppl.* 2007;97(Pt 2):443-9. Review. PubMed PMID: 17691334.
- 87: Seki Y, Samejima N, Komatsuzaki A. Auditory brainstem implants: current state and future directions with special reference to the subtonsillar approach for implantation. *Acta Neurochir Suppl.* 2007;97(Pt 2):431-5. Review. PubMed PMID: 17691332.
- 88: Coulson CJ, Reid AP, Proops DW, Brett PN. ENT challenges at the small scale. *Int J Med Robot.* 2007 Jun;3(2):91-6. Review. PubMed PMID: 17619240.
- 89: Samii A, Lenarz M, Majdani O, Lim HH, Samii M, Lenarz T. Auditory midbrain implant: a combined approach for vestibular schwannoma surgery and device implantation. *Otol Neurotol.* 2007 Jan;28(1):31-8. PubMed PMID: 17195743.
- 90: Lustig LR, Yeagle J, Driscoll CL, Blevins N, Francis H, Niparko JK. Cochlear implantation in patients with neurofibromatosis type 2 and bilateral vestibular schwannoma. *Otol Neurotol.* 2006 Jun;27(4):512-8. PubMed PMID: 16791043.
- 91: Abe H, Rhoton AL Jr. Microsurgical anatomy of the cochlear nuclei. *Neurosurgery.* 2006 Apr;58(4):728-39; discussion 728-39. PubMed PMID: 16575337.
- 92: Roland JT Jr. A model for cochlear implant electrode insertion and force evaluation: results with a new electrode design and insertion technique. *Laryngoscope.* 2005 Aug;115(8):1325-39. PubMed PMID: 16094101.
- 93: Schipper J, Aschendorff A, Arapakis I, Klenzner T, Teszler CB, Ridder GJ, Laszig R. Navigation as a quality management tool in cochlear implant surgery. *J Laryngol Otol.* 2004 Oct;118(10):764-70. PubMed PMID: 15550181.
- 94: Quester R, Schröder R, Klug N. [Optimization of microsurgical operation technique to insert auditory brainstem implants, taking into account the results of a morphometric study]. *HNO.* 2004 Aug;52(8):706-13. German. PubMed PMID: 15309251.
- 95: Suresh S, Barcelona SL, Young NM, Heffner CL, Coté CJ. Does a preemptive block of the great auricular nerve improve postoperative analgesia in children undergoing tympanomastoid surgery? *Anesth Analg.* 2004 Feb;98(2):330-3, table of contents. PubMed PMID: 14742364.

- 96: Seki Y, Samejima N, Kumakawa K, Komatsuzaki A. Subtonsillar placement of auditory brainstem implant. *Acta Neurochir Suppl.* 2003;87:85-7. PubMed PMID: 14518530.
- 97: Klenzner T, Lutterbach J, Aschendorff A, Pedersen P, Stecker M, Laszig R. The effect of large single radiation doses on cochlear implant function: implications for radiosurgery. *Eur Arch Otorhinolaryngol.* 2004 May;261(5):251-5. Epub 2003 Sep 18. PubMed PMID: 14504862.
- 98: Decq P, Chazal J. [Introduction. Hearing and vestibular schwannomas]. *Neurochirurgie.* 2002 Nov;48(5):381-6. French. PubMed PMID: 12483116.
- 99: Kalamarides M, Grayeli AB, Bouccara D, Dahan EA, Sollmann WP, Sterkers O, Rey A. Hearing restoration with auditory brainstem implants after radiosurgery for neurofibromatosis type 2. *J Neurosurg.* 2001 Dec;95(6):1028-33. PubMed PMID: 11765818.
- 100: Rosahl SK, Mark G, Herzog M, Pantazis C, Gharabaghi F, Matthies C, Brinker T, Samii M. Far-field responses to stimulation of the cochlear nucleus by microsurgically placed penetrating and surface electrodes in the cat. *J Neurosurg.* 2001 Nov;95(5):845-52. PubMed PMID: 11702876.
- 101: John NW, Thacker N, Pokric M, Jackson A, Zanetti G, Gobbetti E, Giachetti A, Stone RJ, Campos J, Emmen A, Schwerdtner A, Neri E, Franceschini SS, Rubio F. An integrated simulator for surgery of the petrous bone. *Stud Health Technol Inform.* 2001;81:218-24. PubMed PMID: 11317743.
- 102: Matthies C, Thomas S, Moshrefi M, Lesinski-Schiedat A, Frohne C, Battmer RD, Lenarz T, Samii M. Auditory brainstem implants: current neurosurgical experiences and perspective. *J Laryngol Otol Suppl.* 2000;(27):32-6. PubMed PMID: 11211435.
- 103: Walsted A, Andreassen UK, Berthelsen PG, Olesen A. Hearing loss after cardiopulmonary bypass surgery. *Eur Arch Otorhinolaryngol.* 2000;257(3):124-7. PubMed PMID: 10839483.
- 104: Quester R, Schröder R. Topographic anatomy of the cochlear nuclear region at the floor of the fourth ventricle in humans. *J Neurosurg.* 1999 Sep;91(3):466-76. PubMed PMID: 10470823.
- 105: Colletti V, Fiorino FG. New window for cochlear implant insertion. *Acta Otolaryngol.* 1999 Mar;119(2):214-8. PubMed PMID: 10320079.
- 106: Colletti V, Fiorino FG, Carner M, Pacini L. Basal turn cochleostomy via the middle fossa route for cochlear implant insertion. *Am J Otol.* 1998 Nov;19(6):778-84. PubMed PMID: 9831154.

1)

Thompson NJ, O'Connell BP, Brown KD. Translabyrinthine Excision of Vestibular Schwannoma with Concurrent Cochlear Implantation: Systematic Review. *J Neurol Surg B Skull Base.* 2019 Apr;80(2):187-195. doi: 10.1055/s-0038-1677491. Epub 2019 Jan 24. PubMed PMID: 30931227; PubMed Central PMCID: PMC6438800.

From:

<https://neurosurgerywiki.com/wiki/> - **Neurosurgery Wiki**

Permanent link:

[https://neurosurgerywiki.com/wiki/doku.php?id=cochlear\\_implantation](https://neurosurgerywiki.com/wiki/doku.php?id=cochlear_implantation)

Last update: **2024/06/07 02:53**

