Diagnostic Radiology in Cochlea Implant Surgery: Current Trends and Future Development (Literature Review)

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Abstract

In this article is summarized the literature evidence of radiology diagnostics in patients with high rate of hearing loss and profound deafness. Cochlear implantation (CI) is the only effective way to recover auditory function in this group of patients. According to the goal of radiology diagnostics, all methods can be performed at all surgery stages for pre-, intra- and postoperative diagnostics. The candidates for implant surgery should be analyzed for destruction of temporal bone, pneumatization disorders in the middle ear, and possible developmental anomalies in the inner ear. The first examination in nowadays radiology became multislice computed tomography (MSCT) and magnetic resonance tomography (MRI). The new method among otolaryngologists became cone-beam computed tomography (CBCT). Due to low doze exposure and by a very small metal artefact from metal electrodes the CBCT can be recommended as the standard method of diagnostics before and after cochlear implant surgery. The current interest is the neuronaviation in cochlear implant surgery, based on radiology imaging. Imaging procedures and algorithm of their application in cochlear implant surgery are an essential tool for pre-, intra- and postoperative diagnostics, which have an important practical and scientific value..

Key words: Multislice Computed Tomography (MSCT), Magnetic Resonance Imaging (MRI), Cone-Beam Computed Tomography (CBCT), Cochlear Implantology (CI).

References

1. *Bogomil'skiy M. R., Ivanichkin S. A.* Surgical operations for the improvement of hearing in the children: the current state of the problem. P. II. Ossiculoplasty, stapedoplasty, shunting of the tympanic cavity, cochlear implantation. Vestnik otorinolaringologii. 2012. No. 6. P. 109–113 (in Russian).
2. *Bodrova I. V.* Computed tomography (MSCT) in the diagnosis of diseases of the outer and middle ear: Extended abstract of Ph. D. dissertation. Moscow, 2008. 24 p. (in Russian).
3. *Bryzgalova S. V.* Possibility of X-ray computed tomography to study the structure of the temporal bone and increase the efficiency of diagnosis of inflammatory diseases of the middle ear: Extended abstract of Ph. D. dissertation. St. Petersburg, 2009. 22 p. (in Russian).
4. *Vasil'ev A. Yu., Blinov N. N. (Jr.), Egorova E. A., Makarova D. V., Dutova M. O.* Opportunities of cone-beam computed tomography in the assessment of condition of bones and joints of wrist. Radiologija — Praktika. 2012. N. 6. P. 54–61 (in Russian).
5. *Zubareva A. A., Chibisova M. A., Dudarev A. L., Shavgulidze M. A.* The possibilities of digital 3D tomography in otorhinolaryngology. Luchevaya diagnostika i terapiya. 2011. No. 4 (2). P. 105–118 (in Russian).
6. *Kosyakov V. V., Lazebny V. V., Korshok E. V., Korshok V. V., Pchelenok E. V.* The role of MRI in the preoperative examination and postoperative follow up of the patients presenting with a combi-

nation of chronic otitis media and cholesteatoma. M.: Vestnik otorinolaringologii. 2012. No. 5. P. 14–19 (in Russian).
7. *Kuzovkov V. E.* Modern surgical approaches for cochlear implantation: Extended abstract of Ph. D. dissertation. St. Petersburg, 2011. 48 p. (in Russian).
8. *Starokha A. V., Balakina A. V., Litvak M. M., Knipenberg A. E., Shcherbik N. V., Druzhinin A. I.* Cochlear implantation prevalence in elderly. Bulletin of Siberian Medicine. 2014. V. 13. No. 1. P. 122–128 (in Russian).
9. *Yanov Yu. K., Levinina M. V., Pudov V. I.* Abstracts of Papers, Kokhlearnaya implantatsiya kak metod reabilitatsii invalidov po slukhu. Proceedings of the Conference. St. Petersburg, 2010. P. 79, 80 (in Russian).
10. *Aschendorff A.* Imaging in cochlear implant patients. GMS Curr. Top. Otorhinolaryngol. Head Neck Surg. 2011. V. 10. Doc07.URN: urn:nbn:de: 0183-cto0000807.
11. *Bell B., Gerber N., Williamson T., Gavaghan K., Weber S., Caversaccio M.* Minimally invasive robotic cochlear implantation surgery. Proceedings of the 13th International Conference on Cochlear Implants and Other Implantable Auditory Technologies: Book of Abstracts. Munich, Germany, 2014. P. 138.
12. *Cakli H., Cingi C., Ay Y., Oghan F., Ozer T., Kaya E.* Use of cone beam computed tomography in otolaryngologic treatments. Eur. Arch. Otorhinolaryngol. 2012. V. 269. No. 3. P. 711–720.
13. *Cavalcanti M. G.* Cone beam computed tomographic imaging: perspective, challenges, and the impact of near-trend future applications. J. Craniofac. Surg. 2012. V. 23. No. 1. P. 279–282.
14. *Hirano H.* Usage experience in the otolaryngological field (cochlear implants). Innervision. 2013. V. 28. No. 12. P. 1–3. URL: http://www.shimadzu.com/products/medical/oh80jt0000001x8u-att/5iqj1d000001xz1z.pdf.
15. *Jae Ho Oh, Jae Ho Chung, Hyun Jung Min, Seok Hyun Cho, Chul Won Park, Seung Hwan Lee.* Clinical Application of 3D-FIESTA Image in Patients with Unilateral Inner Ear Symptom. Korean Journal Audiology. 2013. V. 17. No. 3. P. 111–117.
16. *Joshi V. M., Navlekar Sh. K., Kishore G. R., Reddy K. J., Kumar E. C. V.* CT and MR Imaging of the Inner Ear and Brain in Children with Congenital Sensorineural Hearing Loss. RG. 2012. V. 32. No. 3. P. 683–696.
17. *Nateghifard K., Kuthubutheen J., Daly M., Chan H., Lin V.* Cone beam CT vs micro CT of the temporal bone to determine cochlear size measurements for electrode choice in cochlear implantation surgery. Proceedings of the 13th International Conference on Cochlear Implants and Other Implantable Auditory Technologies: Book of Abstracts. Munich, Germany, 2014. P. 720.
18. *Van Loon M. C., Hensen E. F., de Foer B., Smit C. F., Witte B., Merkus P.* Magnetic Resonance Imaging in the Evaluation of Patients With Sensorineural Hearing Loss Caused by Meningitis: Implications for Cochlear Implantation. Otol. Neurotol. 2013. V. 34. No. 5. P. 845–854.
19. *Witte R. J., Lane J. I., Driscoll C. L. W., Lundy L. B., Bernstein M. A., Kotsenas A. L., Kocharian A.* Pediatric and Adult Cochlear Implantation. RG. 2003. V. 23. No. 5. P. 1185–1200.

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