

Facial Nerve Stimulation in Cochlear Implant Patients

Facial nerve stimulation following cochlear implantation is a well recognized, yet not a rare untoward effect of this therapeutic modality. Although this phenomenon was initially considered as a rare complication,^{1,2} later reports, however, proved that the incidence of this complication was not that rare³⁻⁸ and might reach even as high as 14.6% in adults patients.⁹ Some reports have related several pre-operative conditions to the emergence of this complication. One of the most cited conditions is otosclerosis, which has been considered as the most common pre-operative condition in several studies.^{3,6,8,10,11} However, other conditions such as otitic syphilis⁸ or institution of hemodialysis¹² have been reported elsewhere. It seems that the basic common pathophysiology among all these conditions lies in the decreased resistance to electric stimuli to the facial nerve and the implant electrode(s).

This report is an attempt to determine the incidence of this untoward effect and the risk factors in a cohort of patients implanted during the last eleven years in the Amir Aalam Hospital.

Design and Participant Characteristics:

Cochlear Implantation (CI) in Iran was initiated in 1991 for the first time at the Cochlear Implantation Clinic of the Hearing Research Center, Tehran University of Medical Sciences. All the patients treated with this modality formed the cohort of our CI patients. By this time, this cohort consists of 192 patients, with a total of at least 2200 person-months. All these patients received multichannel implants, Nucleus® device in 53 and Clarion® device in the remainder of cases. We encountered facial nerve stimulation in only two patients contributing to a prevalence of about 1.04% and an incidence rate of 0.9 cases per 1000 person-months of post-operative follow-up. The following section shows the characteristics of these two patients.

Pre-operation Conditions:

Both cases were male; the first was a 5 years old at the time of implantation. He had Riley Day syndrome and had no problem beyond the above-mentioned syndrome. On the axial view of the CT scan of this patient, there was a marked narrowing of the internal auditory canal which seemed to indicate absent eighth cranial nerve, but auditory response after implantation proved contrary to this assumption. Hence, facial nerve stimulation might be explained because of unusual closeness of the two nerves.

The second case was a 33-year-old, who experienced sudden deafness one year before the implantation; he had asthma and also had sustained a car accident about four months prior to his hearing loss with no otorhinolaryngologic problems. On the CT scan of this patient, the main finding was the absence of sufficient bone material between the electrode and the first part of the facial nerve, a finding which was not rare in our patients. There were no other important paraclinical findings.

Intra-operative Events:

Both cases received Clarion® Hi-Focus with positioner devices, implanted on their right ears and showed auricular muscle stimulation after implantation. The first signs of facial nerve stimulation were detected during operation and before the fitting procedures. Despite the facial nerve stimulation, the channel impedances in both cases were similar to other cochlear implant cases.

Six weeks after surgery, initial fitting using both Continuous Interleaved Sampler (CIS) and Simultaneous Analogue Stimulation (SAS) methods were started. In the first case, the CIS method using electrode numbers 1-6, showed facial nerve stimulation with a modest increase in M (Most Comfortable Level) stimulation. But using the SAS strategy, the only electrodes numbered 3-5 showed such phenomenon. His hearing and discrimination improved using the latter strategy and no evidence of facial nerve stimulation has remained using this method. In the second case, we tried different channels on and off, using both strategies, and presently(more than one year after implantation), although all channels are on, and the SAS strategy was superior, nevertheless, his speech perception performances is very poor, considering that he is a post-lingual deaf patient.

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Conclusion

While facial nerve stimulation following the implantation of cochlear implant devices is a known complication of this treatment modality, its risk factors remain still unknown. Many different factors and situations have been labeled as possible predisposing conditions for this complication, but none has been ruled out or confirmed in an analytic case control study, given the long list of such factors including otosclerosis,^{3,6,10,11} otitic syphilis⁸, and hemodialysis or other bone-depleting conditions.¹² We found that one of our patients had a history of head trauma and the other one had a rare syndrome which is associated with abnormally narrowed internal auditory canal.

We think that there is an urgent need for a co-operative, multi-center case control study to find the probable etiologic factors involved in this complication and also to find out how far it is an avoidable.

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References

- 1- Cohen NL, Hoffman RA, Stroschein M: Medical or surgical complications related to the nucleus multichannel cochlear implant. *Ann Otol Rhinol Laryngol Suppl* 1988; **135**:8-13.
- 2- Cohen NL, Hoffman RA: Complications of cochlear implant surgery in adults and children. *Ann Otol Rhinol Laryngol* 1991; **100**(9pt1):708-11.
- 3- Weber BP, Lenarz T, Bettmer RD, et al: Otosclerosis and facial nerve stimulation. *Ann Otol Rhinol Laryngol Suppl* 1995; **166**:445-7.
- 4- Graham JM, East CA, Fraser JG: UCH/RNID single channel cochlear implant: surgical technique. *J Laryngol Otol* 1989; **18**:14-9.
- 5- Bredberg G, Lindstrom B: Insertion length of electrode array and its relation to speech communication performance and nonauditory side effects in multichannel-implanted patients. *Ann Otol Rhinol Laryngol Suppl* 1995; **166**:256-8.
- 6- Muckle RP, Levine SG: Facial nerve stimulation produced by cochlear implants in patients with cochlear otosclerosis. *Am J Otol* 1994; **15**(3):394-8.
- 7- Shea JJ, Domico EH: Facial nerve stimulation after successful multichannel cochlear implantation. *Am J Otol* 1994; **15**(6):752-6.
- 8- Bigelow DC, Kay DJ, Rafter KO, et al: Facial nerve stimulation from cochlear implants. *Am J Otol* 1998; **19**(2):163-9.
- 9- Niparko JK, Oviatt DL, Coker NJ, et al: Facial nerve stimulation with cochlear implantation. *Otolaryngol Head Neck Surg* 1991; **104**(6):826-30.
- 10- Kelsall DC, Shallop JK, Brammeier TG, et al: Facial nerve stimulation after nucleus 22-channel cochlear implantation. *Am J Otol* 1997; **18**(3):336-40.
- 11- Marsh MA, Coker NJ, Jenkins HA: Temporal bone histopathology of a patient with a nucleus 22-channel cochlear implant. *Am J Otol* 1992; **13**(3):241-8.
- 12- Iwasaki S, Atsumi K, Ocho S, et al: Facial nerve stimulation by a cochlear implant in a hemodialysis patient with bone of low mineral density. *Eur Arch Otorhinolaryngol* 1998; **255**(7):352-4.
- 13- Rayner MG, King T, Djalilian HR, et al: Resolution of facial stimulation in otosclerotic cochlear implants. *Otolaryngol Head Neck Surg* 2003; **129**: 475-480.

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