International Journal of Clinical Medicine, **2012, 3, 62-64**
http://dx.doi.org/10.4236/ijcm.2012.31014 Published Online January 2012 (http://www.SciRP.org/journal/ijcm)

Facial Nerve Stimulation Can Improve after Cochlear Reimplantation and Postoperative Advanced Programming Techniques: Case Report

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Received October 8th, 2011; revised November 19th, 2011; accepted December 5th, 2011

ABSTRACT

We had a case of 75-year old man with a history of progressive hearing loss on both sides who implanted with a Nucleus 24 Contour Advance in the right ear. After 4 years from implantation, the patient started to complaint of right facial twitching when his cochlear implant was active. Despite undergoing numerous alterations in his implant programming, facial nerve stimulation (FNS) persisted. After increasing the pulse width and changing the stimulation mode, there was no facial nerve stimulation. However there was a deterioration in hearing and speech understanding. CT of the temporal bone showed good position of the implant electrodes und cochleomeatal scintigraphy (CMS) showed a highly positive activity with suspicion of otosclerosis, although the medical history was negative for otosclerosis. The FNS was managed with cochlea reimplantation and advanced programming techniques. FNS in cochlear implant patients may be managed through reimplantation and advanced programming techniques.

Keywords: Facial Nerve Stimulation; Cochlea Implant; Reimplantation; Otosclerosis

1. Introduction

Facial nerve stimulation is a well known complication of cochlear implants. The reason for this adverse effect is not specifically known and there are many theories that attempt to explain this problem. The possible explanation of this complication is either the close proximity of the facial nerve to the outer wall of the cochlea and the need for high electric current to stimulate the auditory nerve or, leakage currents due to a change in the properties of bone, resulting in facial stimulation.

Facial nerve stimulation after cochlear implant may be a self resolving problem or a major complication. The programming system of the cochlear implant system can be used to reduce the facial nerve stimulation. This can be done by lowering the current amplitude by widening the pulse width or by switching off the electrodes which stimulate the facial nerve. However, this may result in decreasing performance with cochlear implant and decrease in speech understanding. Failure to resolve this problem with programming may lead to the indication to removal of the implant assuming a soft failure which cannot be proven by telemetry. This is because too many electrode need to be switched off which influences the speech performance.

2. Case Report

A 75 years old male patient with a history of progressive hearing loss on both side was implanted with a Nucleus 24 Contour Advance (CI24R(CA)) in 2004 in the right ear. Postoperative plain x-ray showed normal position of the implant electrode. The postoperative hearing result after rehabilitation showed significant improvement in hearing and speech understanding and the possibility to communicate and usage of telephone. No facial nerve stimulation was noted. After 4 years from implantation, the patient started to complain of right facial twitching when his cochlear implant was active. Despite undergoing numerous alterations in his implant programming, which included progressive deactivation of electrodes and alteration in the programming strategies his facial nerve stimulation persisted. After increasing the pulse width and changing the stimulation mode, there was no facial nerve stimulation, however there was a deterioration in hearing and speech understanding. CT of the temporal bone showed good position of the implant electrodes und cochleomeatal scintigraphy (CMS) showed a highly positive activity with suspicion of otosclerosis, although the medical history was negative for otosclerosis. After the trail with cochlear implant programming

and conservative therapy with corticosteroids we considered a cochlear reimplantation. The preoperative speech reception threshold was 10 % at 80 dB HL for the right ear, and the pure tone audiogram was 30 dB hearing level (HL) on the right side. Prior to the reimplantation surgery, we carefully determined the hearing (T-Level) threshold and the facial nerve stimulation threshold behaviourally. These thresholds were confirmed objectively and intraoperatively with facial nerve monitor (NIM2, Xomed Company). The old device was removed and replaced by a Nucleus CI512. The insertion depth was complete. After insertion the implant electrode, the neural response telemetry (NRT) and the electrically elicited stapedius reflex thresholds were repeated to confirm the functioning of the electrodes and the hearing threshold under the control of the facial nerve monitoring. After starting the intraoperative neural response telemetry, there was immediately stimulation of the facial nerve. Postoperative transorbital plain view x-ray finding showed correct position of the fully inserted electrode array.

Postoperatively, we used an ACE-strategy at rates of 1800 pps/channel. The patient showed sensitivity to electrical stimulation, and by increasing the threshold below the comfort level the patient started to have FNS of the electrode 11 to 22. A treatment trail with 40 mg natrium fluorid tablet (Ossin®) was done but it was unfortunately stopped because the patient started to complain of joints pain and gastritis without improvement of the FNS. Reducing the pulse width of 75 μs, and stimulation rate of 900 Hz were required to avoid facial nerve stimulation. The postoperative pure tone threshold was 30 dB HL on the implanted side. The patient achieved after a difficult postoperative programming a perception of 81% in the German HSM Sentence Test in quiet and has not experienced FNS with new cochlear implant system.

3. Discussion

This case report showed that cochlear reimplantation and advance programming techniques can resolve the problem of facial nerve stimulation after cochlear implantation. The patient had improvement also in hearing. The cause of FNS in this case could be due to the suspected otosclerosis in the radiological examination, although the history of otosclerosis was unclear. Cochlear implantation has been shown to be a safe surgical procedure with few immediate or long term complications. Otosclerosis may cause demineralisation and otospongiotic changes in the otic capsule and this result in current flow through paths of low electrical resistance, which can results in FNS [1]. Facial nerve stimulation has been described as being more common after cochlear implantation in otosclerotic patient than other groups of patients. There may be pain in the ear from stimulation of the tympanic plexus or dizziness from stimulation of vestibular structures. The electrical fields generated from the cochlear implants produce current flow. The spread of the currents and the stimulation of facial nerve may be affected with many factors such as the anatomy of the labyrinth, stimulus parameters, the position of the electrodes [2].

If programming fails to resolve the problem of FNS, then cochlear reimplantation can be considered. Reimplantation can be done in the same side, as well as in the opposite side. In our case we decide to continue with reimplantation, although FNS was noted intraoperatively during the telemetry test. This was because we want to give trial with programming and to leave the cochlea in a better anatomical condition for reimplantation in the future on the contralateral side. Although reimplantation and programming having the disadvantage of the possibility of recurrence of the same problem in the postoperative period and has the advantage of leaving the other ear a potential source for reimplantation if FNS recurs in the future.

A study by Battmer et al. showed that electrodes facing the modiolus reduce the possibility of FNS due to more focused electrical stimulation [3]. Joong et al presented a study which showed that there is no difference between straight and perimodiolar electrode arrays in normal cochlea. The Contour Advance (soft tip) electrodes offered a significantly lower incidence of FNS than Contour electrode arrays [4]. Stefan et al. presented a strategy in case report of a patient who developed FNS after cochlear implant and it was managed with explantation of the implant and reimplantation of the same device into the contralateral ear [5].

In a study form Polak *et al*., revealed that having more programming options is helpful in otosclerotic patients who experience FNS [6]. Langmann et al. presented a case report of a patient who developed also FNS after cochlear implantation which was treated with botulinum toxin with improvement of the facial function and implant performance. This type of therapy may be an alternative in the treatment of refractory facial nerve stimulation after cochlea implant [7]. Another modality which can be used in the treatment for FNS caused by cochlear implants in otosclerosis is fluoride therapy. The role of fluoride in the treatment of otosclerosis remains controversial [8]. In our case the treatment with fluoride was unsuccessfully as the patient gains no benefit regarding the management of FNS and the development of the above mentioned side effects.

4. Conclusion

FNS in cochlear implant patients may be managed through reimplantation and advanced programming tech-

niques. Close interdisciplinary collaboration between otolaryngology, audiology and neuroradiology is desirable for effective therapy.

5. Anknowledegments

The author wants to thank Mrs. Eileen Winkel-Marsch for her effort in refining the manuscript

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