The Future of Treating Cochlear Nerve Deficiency
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Abstract—The main method of treating cochlear nerve deficiency, in the past, has always been using cochlear implants in hopes of improving an individual’s speech recognition and production. Presently, however, the efficacy of this procedure has been brought into question by way of new studies. These new studies suggest that auditory brainstem implants are the more effective procedure to treat cochlear nerve deficiency. This paper will compare these two procedures and their efficacy.

I. INTRODUCTION

THE COCHLEAR NERVE IS PART OF THE VESTIBULOCOCHLEAR NERVE, A CRANIAL NERVE, LOCATED IN THE INNER. THIS NERVE CARRIES AUDITORY SENSORY INFORMATION FROM THE COCHLEA OF THE INNER EAR TO THE BRAIN[2]. A DEFICIENCY, LACK, OR MALFORMATION OF THIS NERVE MAKES IT DIFFICULT OR IMPOSSIBLE FOR AN INDIVIDUAL TO DEVELOP NORMAL SPEECH PRODUCTION AND RECOGNITION. COCHLEAR NERVE DEFICIENCY NEARLY 28 MILLION AMERICANS AND THAT NUMBER IS PROJECTED TO KEEP RISING[1]. AS OF 2009, 150,000 COCHLEAR IMPLANT PROCEDURES HAVE BEEN PERFORMED WORLDWIDE AND 7,000 ARE DONE IN THE U.S. EACH YEAR. [1] COCHLEAR IMPLANTS MAY HELP TO HELP TREAT THIS CONDITION; HOWEVER, AUDITORY BRAIN IMPLANTS ARE NOW SHOWING MORE PROMISE IN HELPING INDIVIDUALS DEVELOP SPEECH ABILITIES. IN CURRENT STUDIES, AUDITORY BRAINSTEM IMPLANTS ARE MORE EFFECTIVE AND LESS OF A RISK THAN COCHLEAR IMPLANTS.

II. THE TWO PROCEDURES

Cochlear Implantation: Surgeons evaluate the subject’s situation and see if they are a good candidate for the procedure. The subject undergoes audiologic studies and radiographic studies. Their medical history is also evaluated. The patient must be 12 months of age or older to ensure their deafness is legitimate deafness and not meningitis-related deafness, a result of progressive cochlear ossification. Before the subject undergoes surgery, all available hearing aids have to have been tried and failed for them. As obvious, the cochlear implant is used as a last resort because of the risk that is associated with it. After all evaluations prove the patient is a good candidate for the procedure, surgery ensues. A small incision made behind the ear, the posterior bone of the ear is exposed, the aerated bone is removed, implant is placed between skin and muscle around the former location of the aerated bone, another incision is made in the cochlear for the insertion in the cochlea. After the skin is closed, the procedure is complete and the patient begins healing. [3]

Auditory Brainstem Implantation (ABI): The incisions made for this procedure are the same as the ones for the cochlear implantation. The ABI is made up of electrode carrier with 20 small disc electrodes. Once incisions have been made, the disc electrodes are inserted on to the surface of the cochlear nucleus of the fourth ventricle. However, after this particular procedure, there are significant side affects such as facial twitching, pain in the throat, face, or body. Many of these side effects can be fixed post-operation and aren’t long-term.

III. COMPARISON OF DEVICE’S RESULTS

The results provide the evidence to show how much efficacy varies in these two procedures. A recent study shows that auditory brain stem cell implant is much more effective than the cochlear implant, and the ABI had less risk involved. This was concluded from a study where two groups of children had procedures done; half had the auditory brain stem cell implant and the other half had the cochlear implant. During this study, subjects were studied after their respective procedures were done. The children were graded on their auditory performance. Subjects that had undergone the cochlear nerve implantation scored from 0 to 3 levels of performance. While the subjects that had the ABI scored 2 to 7 levels of performance, a much better score. Additionally, subjects with ABIs were able to develop speech recognition and production; these skills were good enough for these subjects to participate in mainstream education, a nearly-impossible feat prior to the procedure. This study also concluded that the complication rate of auditory brainstem implants was not higher than that of the cochlear implant.[5]

IV. DISCUSSION

It is clear to see that ABI is the more effective procedure and has no additional risk associated with it. It only makes sense to pursue progression in the device that is more effective and has less associated risk. The ABI procedure is not only more effective in increasing the scores on the performance test but also allows for the subject to then enjoy a higher quality life. The subjects, post operation, were observed to have developed speech recognition and production. [5]

This study shows that ABIs are the future of treating cochlear nerve deficiency. While the cost is slightly greater for the ABI procedure, the greater effectiveness is worth the slight price increase. Considering effectiveness, risk, and price, the ABI is the procedure that offers the best treatment for those suffering from cochlear deficiency.

<http://emedicine.medscape.com/article/857242-overview#a12>

[3] Cochlear Implant Surgical Procedure
http://www.vanderbilthealth.com/billwilkerson/28094

[4] Cochlear implants and brain stem implants
http://bmb.oxfordjournals.org/content/63/1/183.full