The goal of the present study was to assess the timing and frequency of electrode deactivation over time in post-meningitic cochlear implant (CI) recipients.

METHODS

A retrospective chart review of all post-meningitic CI recipients at New York University from 1984-2008 was conducted. Patients with more than 2 years of follow-up programming and speech perception data were included. Those with cochlear ossification resulting from processes other than meningitis, chronic otitis media, ototoxic agents, trauma or idiopathic processes were excluded. Maximum number of programmable electrodes were determined by type of device and number of electrodes inserted during implantation. Electrodes were deactivated for subjective complaints or for objective evidence of electrode malfunction. Number of deactivated electrodes following initial CI stimulation was recorded.

INTRODUCTION

Bacterial meningitis is a leading cause of acquired profound sensorineural hearing loss (SNHL), particularly in children. Post-meningitic hearing loss is frequently accompanied by an inflammatory process known as labyrinthitis ossificans. This process of intra-cochlear ossification and fibrosis leads to obliteration of the scala tympani in the basal turn of the cochlea in up to 80% of post-meningitic patients. Intra-cochlear osteogenesis is believed to begin between 4-8 weeks following the acute phase of bacterial meningitis, however it has been documented as early as 12 days after infection. Rate of ossification is variable and unpredictable, however it is believed to increase over time and may be ongoing. Degree of ossification and fibrosis affect both surgical technique and electrode selection. Multiple surgical techniques, including a drill-out of the bone near the electrode insertion as well as improved post-operative speech performance have been associated with early cochlear implantation. Prior research by Zeiter et al. (2008) and Carlson et al. (2010) have investigated the prevalence, timing, and relationship of CI deactivation on speech perception and device failure. However, data on electrode deactivation in the meningitic CI population has not been reported.

RESULTS

The present study examined CI electrode deactivation over time in post-meningitic CI recipients and found that 9 of 17 ears (53%) with at least 1 deactivated electrode. This rate is higher than that found by previous authors in non-meningitic populations. Zeiter et al (2008) found that 1% of CI recipients had 1 or more electrodes deactivated following initial stimulation. Loss of 5 or more electrodes was correlated with device failure. Carlson et al. (2010) found slightly higher rates -- 10% of patients in their study experienced 1 or more electrode failures as determined by impedance telemetry. Prior research suggests a positive relationship between number of active electrodes and speech perception, although this appears to plateau with 7-10 active electrodes. As in Zeiter et al (2008), this may account for the lack of decline in performance with loss of 1-6 electrodes in the present study.

Post-meningitic intra-cochlear osteogenesis occurs at variable and unpredictable rates, however evidence suggests that the process may continue after cochlear implantation. Eshragi et al. (2004) evaluated changes in programming of post-meningitic CI recipients and found progressively higher stimulation levels and higher programming modes over time as compared to a control group of non-meningitic patients. They hypothesized that ongoing intra-cochlear anatomic changes, such that osteogenesis, may account for the increased electrical current requirements.

DISCUSSION

Deactivation of CI electrodes over time is common in post-meningitic CI recipients (53%) and exceeds rates from non-meningitic patients (1%). Although electrode deactivation is multi-factorial, anatomic considerations, such as ongoing compromise of the electrode-neural interface by labyrinthitis ossificans, may contribute to deactivation in both the short and long-term.

CONCLUSION