CASE REPORT

Combined Bone Anchored Hearing Aid and Mastoidectomy

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OBJECTIVES: We present four cases of combined mastoidectomy and bone anchored hearing aid implantation

SETTING: Manchester Royal Infirmary

PARTICIPANTS: Four patients who suffered from persistent otorrhoea and conductive deafness

RESULTS: There were no infections of the Bone Anchored Hearing Aid abutment sites and all the BAHAs functioned effectively.

CONCLUSION: We conclude that combined mastoidectomy and Bone Anchored Hearing Aid implantation is a successful procedure in selected patients with no evidence that the BAHA is in any way compromised by the mastoidectomy or vice versa.

The bone-anchored hearing aid (BAHA) has been in use for over 20 years and has been implanted in over 7000 patients [1]. It has several indications but up to 74% of patients are implanted because of acquired conductive hearing loss [2] most cases of which are secondary to chronic suppurative otitis media (CSOM). The fitting of a BAHA allows a patient with CSOM to remove hearing aids from the ear canal. In many cases, removing a mould from the external auditory meatus will be sufficient to decrease the amount of discharge from a chronically infected ear. However, there has been evidence that patients who have had a BAHA fitted due to CSOM, still suffer from otorrhoea [3]. If the underlying pathology does persist, it will need to be addressed to ensure a dry ear. This paper presents four cases of combined mastoid surgery and BAHA implantation; with particular reference to indications and outcomes.

CASE PRESENTATIONS

Case 1

The first case is a 31 year-old male with a childhood history of CSOM, complicated by a clinical diagnosis of left viral labyrinthitis, which resulted in a dead ear on the left and a decrease in hearing on the right to thresholds of 20-30 dB, with no air-bone gap. The patient suffered from chronic left otorrhoea. Examination revealed a posterior perforation with oedematous middle ear mucosa. No cholesteatoma was found. In 2002, he underwent a left cortical mastoidectomy and myringoplasty. However, after the operation, there remained scant discharge and posterior granulation tissue. The patient subsequently underwent a left modified radical mastoidectomy in 2003. Granulation tissue and glue was found in the mastoid tip cells, the incus and malleus were removed and stapes was left in situ. All the granulation tissue was cleared. On examination the following year, the mastoid cavity was found to be lined with middle ear mucosa instead of skin cells and the ear continued to discharge. He had two complaints; the discharging ear and poor directionality in his hearing due to there being no functional hearing in his left ear. To rectify both problems he underwent a left revision mastoidectomy (to try and create a dry ear) and BAHA implantation. Subsequently, he required further revision surgery to remove soft tissue overgrowth at the abutment site 4 months post-operatively.

Case 2

Thw seconf case is a 59 year old male who developed CSOM as a child. In addition, he had worked as a fitter in a noisy environment and subsequently developed bilateral noise-induced hearing loss with bilateral air conduction thresholds of 90-100 dB and bilateral 60 dB air-bone gaps, across all frequencies of sound. He had a central right tympanic perforation and left tympanic retraction. He underwent grommet insertion and subsequently developed bilateral otorrhoea. The patient was a diabetic and this prompted the diagnosis of malignant otitis externa but this was excluded and a diagnosis of bilateral otitis media with intermittent otitis externa was made. The risks of BAHA implantation and mastoidectomy were explained to him and he elected to go ahead. He underwent a right-sided combined approach tympanoplasty and insertion of BAHA in January 2005. Extensive antral mucosal disease was cleared at the time of surgery and the tympanic membrane was grafted. (Figures 1, 2)

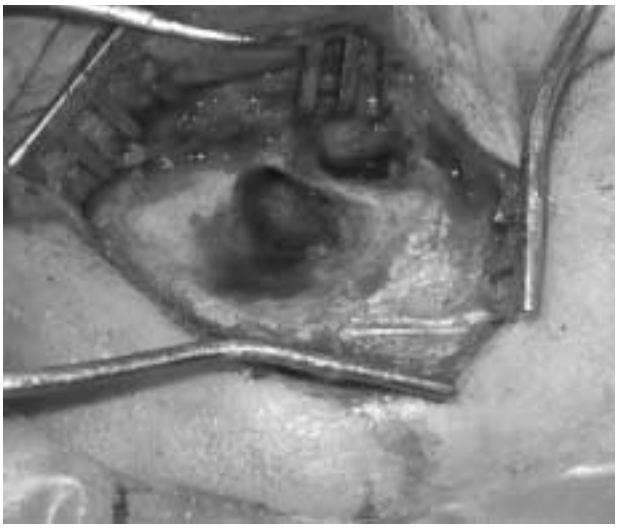

Figure-1: Mastoidectomy

Figure-2: Completed mastoidectomy and BAHA flap

Case 3

The third case was a 10 year old boy with a complex medical history of chromosomal abnormality (deletion on the long arm of chromosome 5) and developmental delay, seizures, tracheostomy for obstructive sleep apnoea and recurrent chest infections. At 10 months old, he was found to have a hearing threshold of 100dB on the right and 60dB on the left. An ABR showed mixed hearing loss. At 18 months of age grommets were inserted. He was subsequently fitted with bilateral conventional hearing aids. He tolerated the hearing aids at school but tended to rub his ears to remove them if they were in for a long time. He continued to suffer from persistent bilateral discharging ears for several years and had difficulty wearing the right hearing aid due to the copious discharge. On examination, there was a huge aural polyp protruding from his right external auditory meatus. He also had difficulty wearing a behind the ear aid on the left due to a nodule on the anti-helix. Excising the nodule would have allowed him to wear a behind the ear hearing aid more comfortably but would not have resolved the persistent otorrhoea. He underwent a right tympanomastoidectomy, aural polypectomy and BAHA insertion. The mastoid was full of granulation tissue which was removed. A BAHA was then inserted with an additional "sleeper" fixture in case there should be any problems with the first fixture. A sleeper is an additional fixture placed posterior to the main fixture at the same operation. It lies underneath the skin. Should there be a problem with the main fixture, the sleeper fixture can be used. This is a useful procedure in patients on whom you want to minimize the chance of further, extensive operative intervention. This was desirable in this patient as he a number of co-morbidities which greatly increased his anaesthetic risk. Children also have thinner skulls and an increased chance of failure of osseointegration and losing the implant [12, 13].

A week later both the BAHA wound and the mastoidectomy wound had healed well. He has had a dry ear since surgery and received his BAHA sound processor four months after surgery. His parents and teacher have noted that he is more alert and responsive when using his BAHA. (Figure 3, 4)

Figure-3: Completed mastoidectomy and BAHA abutment and sleeper insertion

Figure-4: Completed mastoidectomy and BAHA abutment insertion

Case 4

The fourth case is a 26 year old male with a long standing history of bilateral CSOM. He underwent a left mastoidectomy for cholesteatoma at the age of seven. He was lost to follow-up for several years and re-presented three years ago with a left sided discharging mastoid cavity. This was treated with suction and antibiotics. He subsequently developed hearing loss, otoalgia and otorrhoea in the right ear and a polyp was noted to arise from the middle ear cleft. Audiograms showed a bilateral 30-35dB conductive hearing loss. A conventional hearing aid was not effective on the left side due to the bilateral nature of his CSOM. A bone conduction aid was fitted on the right but this caused intolerable headaches. Hence, he underwent right modified radical mastoidectomy and simultaneous right BAHA insertion. He was found to have a sclerotic mastoid with extensive cholesteatoma in the middle ear. The canal wall was taken down to remove all visible disease. The BAHA insertion was straightforward with a good quality graft. He subsequently went on to use the BAHA to good effect.

Audiological assessment

All patients underwent the routine audiological assessment for BAHA as practiced routinely at our institution (REF). Air conduction and bone conduction thresholds are measured for both ears. The patient is then given a trial of a bone conduction hearing aid on a head band. If they find this beneficial, they are recommended as being appropriate for BAHA insertion.

Operative Procedure

The operative procedure for BAHA insertion is described elsewhere [4] and the form of mastoid surgery is tailored to the patients underlying pathology. We perform the mastoid procedure first via a post auricular incision. The wound is then sutured and the BAHA is inserted. We do not routinely use antibiotics. The two procedures were performed as they would be if they were performed separately. There were no modifications. The mastoidectomy is performed first.

DISCUSSION

BAHA implantation has been combined with acoustic neuroma surgery [5] and auricular prosthesis insertion [6]; [7], but to our knowledge, this is the first report of combined BAHA and mastoid surgery.

In patients with conductive hearing loss whose middle ear is not amenable to reconstruction due to the extent of the disease, mastoid surgery may ensure a clean, dry ear. BAHA surgery alone may restore the patients hearing, but the untreated middle ear disease may progress [8] and continuous otorrhoea is known to damage the cochlea in the longterm[9]. We therefore advocate combined mastoid surgery and BAHA in these patients. We have not postulated any specific criteria for patient selection regarding the length or severity of discharge, but following audiological assessment, we have performed a combined procedure on these four patients on an ad hoc basis.

One anticipated problem is spread of infection from an infected post auricular wound to the BAHA. The incidence of wound infection following mastoid surgery is 3-6% [10, 11]. Prevention of infection by meticulous care of the BAHA site is routine in the post-operative care of all BAHA patients [1]. None of our patients had a post auricular wound infection and there were no infections of the BAHA abutment sites.

In patients with a potentially poor otological outcomes following conventional middle ear surgery and reconstruction, due to extensive disease, combined BAHA and mastoidectomy has good outcomes in terms of hearing and a dry ear. There is also the added benefit (as seen in the third case) of patients with serious co-morbidities having to undergo only one anesthetic.

CONCLUSION

All four patients are regularly followed up as outpatients and have been for at least three years. There have been no long-term complications as a result of

performing the procedures simultaneously. Audiologically, the BAHA has improved aided thresholds in each patient and they have all been satisfied with the improvement in hearing. In our third case, where it is not possible to directly ask the patient about the subjective improvement in hearing due to his developmental delay, his family, carers and teachers report that he is much more responsive and interactive.

We conclude that combined mastoidectomy and BAHA implantation is a successful procedure in selected patients with no evidence that the BAHA is in any way compromised by the mastoidectomy or vice versa.

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