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Using autogenous mastoid cortical bone cap to cover the mastoidectomy defect during cochlear implantation

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ABSTRACT

Objectives: Assessment of autogenous mastoid cortical bone cap to cover the mastoidectomy defect via transmastoid and posterior tympanotomy approach surgical technique during cochlear implantation.
Methods: A chart review of the autogenous mastoid cortical bone cap to cover the mastoidectomy defect via transmastoid and posterior tympanotomy approach surgical technique in 540 patients undergoing cochlear implantation was undertaken from January 2010 and December 2013 in Anhui Provincial Hospital.
Results: The mastoidectomy defect was reconstructed using autogenous cortical bone cap in all cochlear implantation patients. No depression was found in the postauricular site. None of the patients had experienced any immediate or delayed postoperative infection complication such as wound infection, post-auricular abscess or intracranial complication.
Conclusions: The technique of autogenous mastoid cortical bone cap to cover the mastoidectomy defect is a good option during cochlear implantation via transmastoid and posterior tympanotomy approach. It can prevents depression of the postauricular site, and also may be able to prevent infection of the wound and the implanted processor. Autogenous cortical bone cap is easy to handle, ready available, stable, resorption resisting, also cost-saving in cochlear implantation surgery.

1. Introduction

Cochlear implantation (CI) is a standard treatment for severe-profound sensorineural hearing loss. Worldwide, over 200,000 implants have been placed to date and a great deal of effort has been expended to develop surgical techniques that allow for optimal use and minimize rates of complication and device failure [1]. The classic technique for cochlear implantation is the retroauricular canal wall-up mastoidectomy with posterior tympanotomy approach, as described by House [2,3]. Over the decades, although several alternative techniques have been introduced, the mastoidectomy with posterior tympanotomy approach has still been the most commonly used surgical technique worldwide.

As the incidence of major complications of CI surgery is reduced to low levels, increasing attention has been focused on other less serious complications such as the development of the undesirable postoperative cosmetic deformities. Intact-canal-wall mastoidectomy procedures will leave a mastoid cavity, even though unproblematic in most cases, can leave an unsightly depression in the postauricular area. This may be of some significance when behind-the-ear external sound processors are used [4]. Even mastoid cavity can enhance the risk of a postoperative infection of the implanted processor, as the middle ear spaces become closely connected to the implantation site [4]. Postoperative middle ear infections, such as acute otitis media, chronic otitis media, theoretically will carry a high risk of wound infection, given the potential for spread along the electrode to the receiver. Efforts to minimize this morbidity are now more critical than ever. Until now, there have been few reports of reconstruction of canal wall-up mastoidectomy defects in cochlear implantation. This is a retrospective study of 540 patients who underwent reconstruction of a mastoidectomy defect with autogenous mastoid cortical bone cap in CI.

2. Patients and methods

Between January 2010 and December 2013, a total of 540 patients received cochlear implants from 8 months to 12 years with a mean of 3.4 years in Anhui Provincial Hospital. 328 Patients (60.7%) were

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male, and 212 were female (39.3%). 460 Cochlear implants were performed on the right ear and 80 on the left.

The audiological evaluation consisted of auditory brainstem response audiometry (ABR) and otoacoustic emissions (OAE). All patients underwent a radiological evaluation consisting of high-resolution computed tomography (HRCT) of the middle ear and inner ear, and magnetic resonance imaging (MRI) of the brain and inner ear, including contrast-enhanced T1 weighted images and T2 weighted constructive interference steady state images of the cochlea.

All patients were performed under general anesthesia. Surgery was performed via a retroauricular approach, mastoidectomy and posterior tympanotomy. After the mastoid cortex was widely exposed. A 1 to 2 mm cutting burr was used to create groove in the cortical bone just inferior to the temporal line and parallel to the posterior bony meatus. Then a third line was drilled at the probable posterior extent of pneumatization (Fig. 1). The groove was about 1 to 2 mm wide and 2 mm deep. This created a triangle area of cortical bone. The cortical bone cap in the triangle was then removed with chisel. Care should be taken to avoid injuring the sigmoid sinus.

Then the mastoidectomy were performed in all cases. After identification of aditus ad antrum and short process of the incus, posterior tympanotomy was performed through facial recess. Through the posterior tympanotomy, the round window niche was identified. Then diamond burr (0.5, 1 mm) was used to remove the round window niche overhang, maximally exposing the round window membrane. Bony seat was drilled into the skull bone to place the receiver stimulator. The bottom of the bed be drilled down to the region of the dura, and a small central island of bone be preserved. A trough was made with drill from the well to the mastoid. After placed the receiver stimulator in the bony seat, the round window membrane was then carefully incised using a fine-curved pick, and the electrode array was carefully inserted through the round window membrane, angled circumferentially along the basal turn of the cochlea. The round window membrane was then closed with small pieces of temporalis fascia.

After the electrode array was coiled in the mastoid cavity, dried gelatin sponge was put in the cavity. Then the cortical bone cap was covered on the surface of the mastoid cavity (Fig. 2). About 3 min was used to harvest bone cap and reconstruction in surgery.

3. Results

The mastoidectomy defect was reconstructed using autogenous cortical bone cap to cover in all CI patients. The sigmoid sinus or tegmen mastoideum was not injured in any patients. None of the patients have experienced any immediate or delayed postoperative infection complication such as wound infection, post-auricular abscess or intracranial complication during an average follow-up period of 6–36 months. No depression was found in the postauricular site. Fig. 3 displayed in an individual at the CI revision surgery that the cortical bone cap, which had grew together with remnant cortical bone, was found normal and in proper position and integrity. Some patients underwent postoperative CT scans of the temporal bones, which showed the bone cap was in normal position and integrity (Fig. 4).

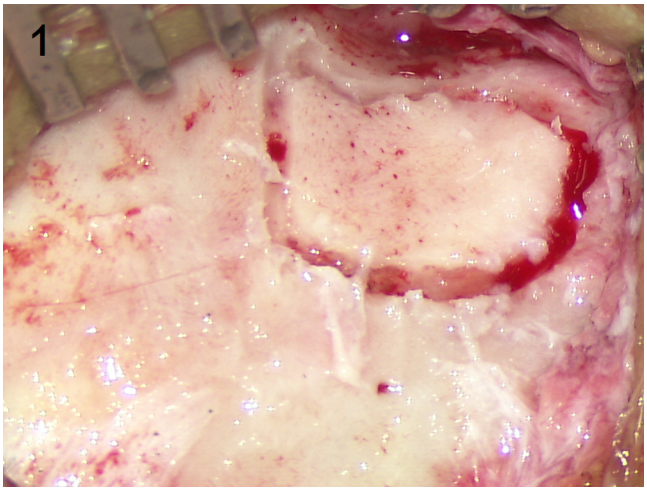

Fig. 1. The triangle area of cortical bone cap.

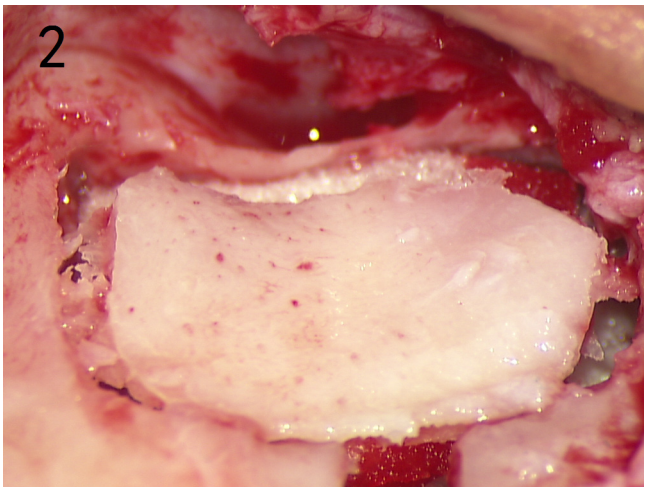

Fig. 2. The cortical bone cap was covered on the surface of the mastoid cavity.

4. Discussion

During the canal wall-up mastoidectomy with posterior tympanotomy approach in CI surgery, mastoid bone is removed, resulting in a large bone defect. This bone defect is traditionally left alone, and usually filled with soft fibrous tissue extending from the postauricular subcutaneous tissue, and this can results in an unsightly depression in the postauricular area [5]. After patients have recovered from surgery, they begin to focus on the less serious complications such as cosmetic results and often complain about such a deformity. Patients who wear sound processors or

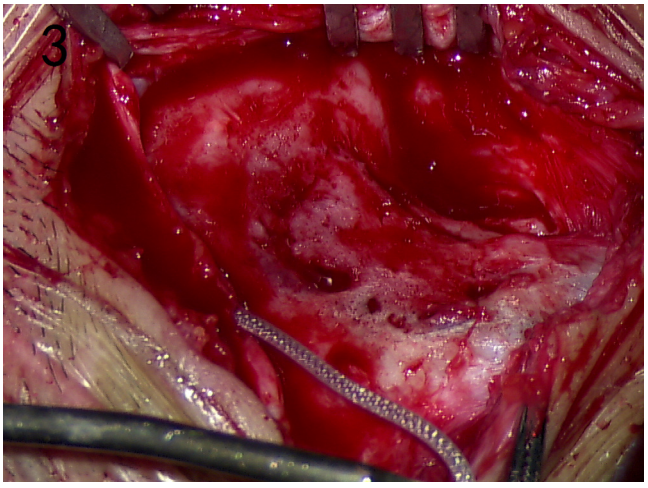

Fig. 3. The cortical bone cap, which had grew together with remnant cortical bone, was found normal and in proper position and integrity in an individual at the CI revision surgery.