

## Cochlear Implantation in Atelectasis and Chronic Otitis Media: Long-Term Follow-Up

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**Objective:** To report the long-term results of cochlear implantation in cases with chronic otitis media or atelectasis using a single surgical technique performed in a single cochlear implant center.

**Patients:** Nine patients who were implanted using the blind-pit closure of the external ear canal technique (4 patients with adhesive otitis media and 5 with radical mastoid cavities). Follow-up ranged from 18 months to 12 years (mean, 7.05 yr).

**Intervention:** The surgical procedure was performed in 2 stages. The first stage included canal wall down or lowering any high facial ridge in previous mastoidectomies, removal of all skin, and blind-pit closure of the external ear canal without mastoid cavity obliteration or eustachian tube obliteration. Cochlear implantation was performed 6 months after the first surgical procedure.

**Results:** All operations were uneventful, and during cochlear implantation, as a second stage, no epithelia or other problems

were encountered. No serious complications were encountered during the follow-up period. One case had a minor disruption of the external canal closure that was reclosed successfully under local anesthesia. All patients were using the device at the last follow-up interval with no device problems.

**Conclusion:** Blind-sac closure of the external ear canal without obliteration is a rather safe surgical procedure in cases with chronic otitis media or atelectasis. Meticulous surgical technique and proper patient selection are of paramount importance. However, a 2-stage procedure may not always be necessary and might best be confined to those patients who have active inflammatory disease at the primary procedure. **Key Words:** Atelectasis—Blind-pit closure—Cholesteatoma—Chronic otitis media—Cochlear implant—External ear canal closure—Gul de sac.

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Profound sensorineural hearing loss may develop in the course of chronic otitis media, either incidentally or secondary to the disease and its treatment. In the past, cochlear implantation was contraindicated in such cases because of the perceived high risk of complications including infection, meningitis, cholesteatoma recurrence, and device extrusion. Gradually, several studies in the literature reported successful implantation in cases with chronic otitis media or atelectatic ears (1,2). However, most of these studies have assessed a small sample of patients during a short follow-up period (taking into account that complications may occur many years after implantation [3]) or have used various surgical techniques or included cases from different cochlear implant centers, making the results and any related conclusions weak and not generalizable.

The aim of the present study is to report the long-term results of cochlear implantation in cases with chronic otitis media or atelectasis using a single surgical technique performed in a single cochlear implant center.

### MATERIALS AND METHODS

The present study included 9 patients who were implanted in our department using the blind-pit closure of the external ear canal technique. The surgical procedure was performed in 2 stages. The first stage included canal wall down or lowering any high facial ridge if a radical mastoidectomy had been performed in the past, removal of all skin, and blind-pit closure of the external ear canal without mastoid cavity obliteration or eustachian tube obliteration. Cochlear implantation was performed, as a second-stage operation, 6 months after the first surgical procedure.

There were 4 women and 5 men. Four patients had adhesive otitis media, and 5 had radical mastoid cavities from previous cholesteatoma operations. The age of patients ranged from 49 to 78 years. Seven patients received the Nucleus device, and 2 received the Clarion device. Follow-up ranged from 18 months to 12 years (mean, 7.05 yr).

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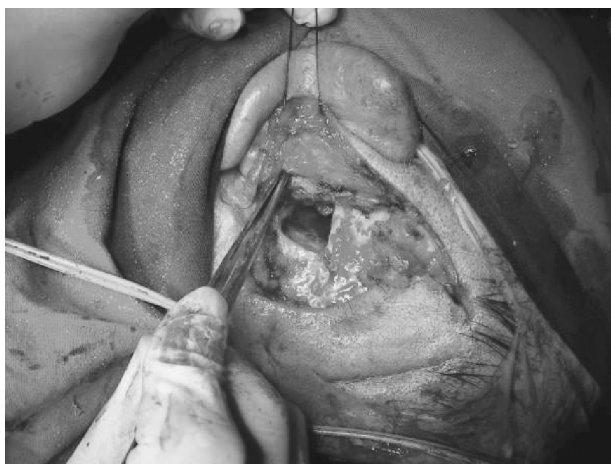
## RESULTS

All operations were uneventful using the above-mentioned surgical technique (canal wall down mastoidectomy or revision mastoid surgery, removal of all skin, blind-pit closure of external ear canal without mastoid cavity obliteration or eustachian tube obliteration, and cochlear implantation in 6-month time). During the cochlear implantation, as a second stage, no epithelia or other problems were encountered (Fig. 1). In all cases, the cavity contained air and soft tissue. Finding the round window was straightforward and was considered easier than the standard posterior tympanotomy approach.

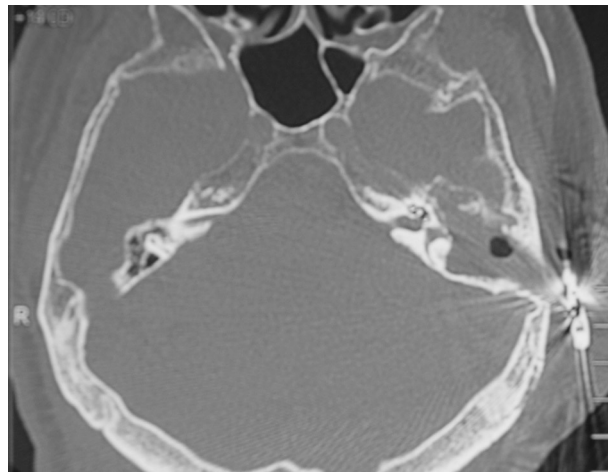
Patients were regularly followed-up clinically, and a computed tomographic (CT) scan assessment was performed at the first year interval and then every 3 to 4 years. However, CT scan showed mostly soft tissue and a little of air in the cavities (Fig. 2), not allowing differential diagnosis of a possible cholesteatoma. Therefore, this was done by assessing whether the soft tissue was expanding or eroding bone and adjacent structures. No such cases or other serious complications were encountered during the follow-up period. Some minor problems were managed successfully with conservative treatment (1 case with minor disruption of the external canal closure was reclosed successfully under local anesthesia). No infections such as acute otitis media were encountered. No erosions or electrode extrusions were found during the follow-up. All patients were using the device at the last follow-up interval, and electrophysiological testing and tuning did not reveal any device problems.

## DISCUSSION

Since the early 1990s, cochlear implantation was attempted in cases with chronic otitis media. However, early reports were rather disappointing because 3 of 3 patients in the initial Melbourne series had recurrence of middle ear disease, and one of them had a life-threatening



**FIG. 1.** Intraoperative picture at Stage 2 (just before cochlear implantation).



**FIG. 2.** CT scan showing the electrode array in the cochlea and the cavity filled with soft tissue and a little of air.

complication necessitating removal of the implant (4). Later studies reported much better results as fewer complications occurred, and cochlear implantation is now considered a relatively safe procedure in chronic otitis media (1,2). Olgun et al. (1), in one of the largest series in the literature (39 cases), reported complications in 23% of cases, most of them requiring revision surgery. In cases where the subfacial nerve implantation was used, the authors did not have any surgical complications. However, this study included cases from different cochlear implant centers (one of them contributed with only 1 case) using various surgical techniques or modifications, and the follow-up was short, ranging from months to a few years. El-Kashlan et al. (5), in another large series of 28 patients, suggested that external ear canal closure can be done in cochlear implantation with relatively low risk. However, the authors had mixed up 2-year-old children with 74-year-old adults with various diseases including congenital malformations. Basavaraj et al. (6) suggested that, in chronic otitis media, implantation can be performed in a single stage, obliterating the mastoid cavity and closing the external ear canal. However, the number of cases studied was small (4 patients), and the same surgical technique was not used in all patients. Incesulu et al. (7) reported the results of cochlear implantation in 6 patients with chronic otitis media. Again, the authors had included various techniques including tympanostomy tube insertion, and follow-up was short, not exceeding 3.5 years. Axon et al. (8) reviewed 9 implanted patients with chronic otitis media. Some patients were managed with single-stage and others with 2-stage procedures. Not all of them had blind closure of the external ear canal, and follow-up was rather unclear (around 2 yr). Gray et al. (9) reviewed 16 implanted patients with long-term chronic middle ear disease. Again, there was not a single surgical technique used. However, most of the patients had a 2-stage procedure that involved fat obliteration and closure of the external ear canal. In the 5-year follow-up, complications included cholesteatoma, breakdown of the blind

pit, graft abscess, and temporary facial nerve palsy. Finally, Hamzavi et al. (2) reported 7 implanted cases of radical cavities using 1-step subtotal petrosectomy with obliteration and blind-sac closure of the external ear canal fixating the electrode array with muscle flaps and bone pate. The authors did not have any surgical complications. However, mean follow-up was less than 3 years.

It seems that most of the above studies have serious weaknesses either in the design or the follow-up of the different surgical techniques and populations studied.

The present study from a single cochlear implant center used the same surgical technique in all patients studied and had a mean follow-up exceeding 7 years. Cavity and eustachian tube fat obliteration may prevent infections coming from nasopharynx through the eustachian tube but may very well lead to accumulation of secretions in the cavity because there is no drainage. Nevertheless, the present study suggests that obliteration is not necessary and mastoidectomy with blind-sac closure of the external ear canal is a rather safe surgical procedure in cases where standard cochlear implantation (10) cannot be performed. No erosions or electrode extrusions were encountered during the follow-up. However, cartilage could be used to further protect the electrode array.

Minimal or no complications can be attributed to meticulous surgical technique by experienced otologists and proper patient selection. However, a 2-stage procedure may not always be necessary and might best be confined

to those patients who have active inflammatory disease at the primary procedure.

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