

# Simultaneous Cochlear Implantation and Treatment of Chronic Suppurative Otitis Media With or Without Cholesteatoma

## Kolesteatomlu veya Kolesteatomsuz Kronik Otitis Media Tedavisi ve Eşzamanlı Koklear İmplantasyon

Raşit CEVİZCİ, MD, Yıldırım A. BAYAZIT, MD

İstanbul Medipol University Faculty of Medicine, Department of Otolaryngology, İstanbul

### ABSTRACT

**Objective:** To report the results of our experience in patients who had a cochlear implant (CI) with simultaneous treatment of chronic suppurative otitis media (CSOM) with or without cholesteatoma. **Material and Methods:** Five adult patients with unilateral CSOM and bilateral profound hearing loss were included. Since the contralateral uninfected ears of the patients had auditory deprivation since childhood (>40 years), they received a CI in their ears with CSOM. One of patients had CSOM with recurrent cholesteatoma, and underwent a revision radical mastoidectomy and blind sac closure of the external ear canal without mastoid cavity obliteration. A canal wall up procedure was performed in the other patients. All patients received the CI in the same stage. **Results:** The follow up period ranged from 1 to 8 (mean 4.9) years. The postoperative follow up was uneventful for the patients with CSOM. No recurrence of cholesteatoma was encountered in the follow up. **Conclusion:** Our long-term follow up experience showed that a canal wall up procedure without cavity obliteration is a safe procedure in single stage CSOM and CI surgery.

#### Keywords

*Cochlear implant; chronic otitis media; cholesteatoma*

### ÖZET

**Amaç:** Kolesteatomlu veya kolesteatomsuz kronik süpüratif otitis media (KSOM) tedavisi ile birlikte eş zamanlı koklear implantasyon sonuçlarımızı sunmak. **Gereç ve Yöntemler:** Tek taraflı KSOM ve bilateral derin işitme kaybı olan beş yetişkin hasta çalışmaya dahil edildi. Hastaların enfekte olmayan karşı taraf kulaklarındaki işitme kaybı çocukluk çağından beri (>40 yıl) olduğu için, koklear implant (KI) KSOM'lu kulağa takıldı. Hastaların bir tanesinde rekürren kolesteatomlu KSOM mevcuttu. Hastaya revizyon masteidektomi yapıldı ve mastoid kavite obliterasyonu olmaksızın dış kulak yolu kör kese olarak kapatıldı. Diğer hastalara "canal wall up" timpanoplasti tekniği uygulandı. Bütün hastalara eş zamanlı KI takıldı. **Bulgular:** Takip süresi 1 ile 8 yıl arasında değişmekteydi (ortalama: 4.9 yıl). Ameliyat sonrası takiplerde sorun yaşanmadı. Takip süresinde kolesteatom rekürrensi gözlenmedi. **Sonuç:** Uzun dönem takip sonuçlarımıza göre kavite obliterasyonu olmaksızın "canal wall up" tekniği eş zamanlı KI ve KSOM cerrahisinde güvenli bir prosedürdür.

#### Anahtar Sözcükler

*Koklear implant; kronik otitis media; kolesteatoma*

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Correspondence

Raşit CEVİZCİ, MD

Medipol University Faculty of Medicine,  
Department of Otolaryngology, İstanbul, Turkey  
e-mail: rachous\_81@yahoo.com

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## INTRODUCTION

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In some cochlear implant (CI) candidates there may be a coexisting infectious process in the middle ear or mastoid such as chronic suppurative otitis media (CSOM) or cholesteatoma. In addition, biofilms are statistically more common in patients with CSOM compared with controls.<sup>1</sup> Any infectious process in the implant area must be taken into account carefully as this may have the potential to cause implant extrusion, labyrinthitis, wound break down, or meningitis.

Despite these potential risks, cochlear implantation has to be performed in patients who have CSOM with or without cholesteatoma. It is still controversial whether the cochlear implantation and treatment of CSOM must be performed in single stage or the procedure must be staged. In cases of simple dry perforation, grafting and cochlear implantation can be performed as a single stage procedure or in two stages. In cases of active CSOM with or without cholesteatoma, most surgeons prefer to stage the procedure. The other controversial issue is how to treat the CSOM in a CI candidate.

In this study, we aimed to report the results of our experience in patients who received a CI with simultaneous treatment of CSOM with or without cholesteatoma.

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## MATERIAL AND METHODS

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Among the patients who received a CI between October 2003 and June 2014, 5 patients with unilateral CSOM and bilateral profound hearing loss were recruited. The ages ranged from 52 to 70 years, and all were men. The contralateral ears of these five patients were deaf since childhood (>40 years). Their diseased ears had a progressive hearing loss in the last several years, preceded by a profound hearing loss. Because of long term auditory deprivation in the contralateral ears, cochlear implantations were performed in the ears with COM. Study was approved by the local ethics committee.

Of 5 patients, 4 had CSOM and 1 had recurrent cholesteatoma. All patients except for the cholesteatoma patient were primary cases without a history of previous ear surgery. The cholesteatoma patient had undergone a modified radical mastoidectomy previously. After ENT examination, and audiological (pure tone and

speech audiometry, auditory brainstem response testing) and radiological (temporal bone computed tomography) examinations, the operations were performed. The patients with CSOM had perforated ear drums and inflammation, granulations and edema in the middle ear mucosa. No bacterial examination was performed prior to operation. The patients were treated with topical ciprofloxacin ear drops for two weeks prior to operation. None of the ears were running at the time of surgery. Audiological assessment revealed profound hearing loss, and candidacy of the patients for a CI surgery. Radiological assessment was used to confirm that the disease is limited to the middle ear and mastoid air cells as well as adequacy of the cochlea for an electrode insertion.

The surgical procedure was made under endotracheal general anesthesia, using retroauricular incision. In CSOM cases, a mastoidectomy and posterior tympanotomy was made, leaving the posterior buttress intact. The tympanomeatal flap was elevated in the external ear canal and middle ear was entered. The granulations were cleared, and incus was removed. If necessary the head of the malleus was cut. This way, the middle ear, attic, supratubal recess, perilyabyrinthine and perifacial cells, and mastoid air cells were cleaned. Tympanic membrane grafting was made using temporalis fascia. The implant receiver was placed in subperiosteal pocket and the electrode was inserted through the posterior tympanotomy and round window or cochleostomy. The ear canal was packed with gelfoam and merocel, which were removed after one week. In cholesteatoma patient the radical mastoidectomy cavity was entered, and all epithelium, cholesteatoma and granulations were removed either by dissection or by drilling. The Eustachian tube was blocked with bone chips and muscle. The external auditory canal was cut and closed by sutures. The electrode was inserted via round window. No fat or muscle obliteration was made in the cavity. All patients were discharged the day after the surgery.

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## RESULTS

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The follow up period ranged from 1 to 8 (mean 4.9) years. The postoperative follow up was uneventful for the patients in CSOM. The tympanic membrane graft remained intact without re-perforation or retraction. There was no sign of recurrence of disease in the clinical follow up. A chronic imbalance started in the cholesteatoma patient three months after the surgery,

which did not respond to anti-vertiginous medications and vestibular rehabilitation. Therefore a transmastoid labyrinthectomy was performed after one year, which resulted in relief of the imbalance problems. No recurrence of cholesteatoma was encountered in the follow up (Table 1). All patient performed good with their cochlear implants. At 1-year follow-up, the mean open-set sentence scores were  $73.2\% \pm 17$  in quiet and  $59\% \pm 19$  with 10 dB signal-to-noise ratio.

## DISCUSSION

Cochlear implantation in the presence of CSOM has been a critical issue because of the potential complications.<sup>2,3</sup> However, it is unclear whether cochlear implantation itself or preexisting risk factors, or a combination of both would increase the risk in CI recipients.<sup>4</sup> A meticulous surgical technique by experienced otologists and proper patient selection may decrease the likelihood of complication.<sup>5</sup> Despite these facts, in order to optimize the results and minimize the risks of CI surgery in CSOM, different surgical procedures have been advocated.

One of the controversial issues is whether to operate the patients in one stage or in two stages. The other issue is how to manage the COM and perform a safe implantation. It is generally accepted that cochlear implantation must be performed as a staged procedure in the presence of a CSOM with or without cholesteatoma.<sup>5</sup>

Mastoid obliteration with cochlear implantation can be undertaken as a one or a two stage procedure, depending on the presence of active infection or cholesteatoma.<sup>6,7</sup> In a staged surgery for CSOM with or without cholesteatoma, at first stage, the diseased tis-

ues are removed, the mastoid cavity is revised or a radical mastoidectomy is performed, the external ear canal (EAC) is closed after resection of the malleus, incus, tympanic membrane remnant, and any fibro-epithelial tissue in the cavity. The middle ear and mastoid cavity may be obliterated by muscle or fat.<sup>8,9</sup>

Mastoid obliteration can be performed before cochlear implantation.<sup>7</sup> Obliteration of the tympanomastoid cavity can be preceded by subtotal petrosectomy, that is, complete exenteration of all accessible air cell tracts of the temporal bone, sealing the eustachian tube and blind sac closure of the external ear.<sup>10,11</sup> It was suggested that the tympanomastoid cavity obliteration aims to create a closed and sterile cavity which could reduce the risk of infection associated with inserting a foreign body, which is a CI. Another option would be obliteration of the mastoid cavity with bone chips with reconstruction of the bony posterior wall.<sup>12</sup> On the other hand, after performing a radical mastoidectomy or cavity revision and blind sac closure of the EAC, the middle ear and mastoid.<sup>8</sup> Nonobliteration of the cavity seems advantageous, as it allows a better evaluation of the ear. High resolution computerized tomography may eliminate the need of a second look operation.<sup>8</sup> By contrast, after cleansing the middle ear and mastoid, no obliteration and blind sac closure of the EAC is performed. Rather, a groove is drilled in the mastoid cavity to stabilize the electrode, or stabilization of the electrode can be performed with either bone cement or cartilage. This way the ear canal is left open. The main advantage of this technique is that a relapsing cholesteatoma can be monitored in an office setting.

Cochlear implantation can also be performed as a single stage procedure in CSOM with or without cholesteatoma.<sup>6,13</sup> This option is usually preferred if

**Table 1.** Parameters of the patients who received a cochlear implant (CI) and treated for chronic suppurative otitis media (CSOM) in single stage.

Patient	Age (year)	Diagnosis	Surgical proceure with simultaneous cochlear implantation	Complication	Follow up (year)
1	52	CSOM	Canal wall up + Medel CI	None	7
2	65	CSOM	Canal wall up + Medel CI	None	6
3	57	CSOM	Canal wall up + Nucleus CI	None	1
4	70	CSOM	Canal wall up + Advanced Bionics CI	None	8
5	58	CSOM with cholesteatoma	Revision radical mastoidectomy and blind sac closure of EAC + Medel CI	Chronic imbalance	7

CI: Cochlear implant; CSOM: Chronic suppurative otitis media.

there is an inactive CSOM with a dry perforation or a stable cavity.<sup>9</sup> Single stage surgery with subtotal petrosectomy can be performed.<sup>5</sup> The EAC can be closed without middle ear and mastoid cavity obliteration.<sup>14,15</sup> If the EAC closure is not intended, measures can be taken to protect the electrode cable, such as retrofacial placement of the electrode cable or electrode cable coverage within the mastoid cavity using cartilage or a vascularized flap. Middle fossa approach access to the cochlea bypassing the possible infected conventional route for cochlear implantation is also advocated.<sup>16</sup> A transmeatal approach as a single stage procedure is also suggested in a poorly pneumatized mastoid or severe adhesive otitis media.<sup>13</sup>

In the presence of a radical cavity, one of the options would be obliteration of the middle ear and mastoid in association with cochlear implantation. The other option would be the reconstruction of posterior canal wall or partial obliteration of the cavity with the insertion of the electrode array beneath the flap covering the cavity. One of the potential problems with obliteration procedures is the entrapment of squamous epithelium resulting in later cholesteatoma development.<sup>8</sup> In this context, cholesteatoma recurrence was reported after posterior canal wall reconstruction and obliteration of radical cavities.<sup>13</sup>

Single stage minimizes the need for repeated general anesthetics and reduces the total cost for implantation of that ear. All potential complications like cholesteatoma, implant extrusion, wound breakdown and retraction pocket exposing the electrode array may occur after either single staged or staged procedures. But there is a possibility of infection even in a staged operation, and residual or recurrent cholesteatoma can occur any time postoperatively and a second look operation before implantation does not prevent from cholesteatoma recurrence.<sup>6,17</sup> This means, delaying cochlear implantation for 6 months in a staged procedure would not significantly change the outcome.

In conclusion, the previous studies recommend single or two stage procedures with or without cavity obliteration. The results of our experience with long term follow up show that a canal wall up procedure without cavity obliteration is a safe procedure in single stage CSOM and CI surgery. We advocate blind sac closure of the EAC without tympanic and mastoid cavity obliteration in the presence of cholesteatoma or radical cavity. We advocate a single stage surgery since a staged operation will lead to loss of time in a patient who can not hear. However, it is difficult to justify this contention. Therefore our results need replication in larger case series.

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