Results of single stage ossicular reconstruction by incus transposition in patients with chronic otitis media

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ABSTRACT

Objective: To evaluate outcome of single stage ossicular reconstruction in patients with chronic otitis media.

Methods: We assessed thirty-three patients with chronic otitis media who underwent either tympanomastoidectomy or tympanoplasty together with ossicular reconstruction by incus transposition. All had audiotympanometry before and after operation. Air Bone Gap (ABG) and Speech Reception Threshold (SRT) were also calculated pre and postoperatively.

Results: The mean preoperative ABG was 47.27±6.39 dB while mean postoperative ABG was 13.91±7.96 dB (p<0.05). The mean preoperative SRT was 58.06±6.60 dB while mean postoperative SRT was 24.27±7.78 dB (p<0.05). Postoperative ABG was less than 20 dB in 25 (75.8%) patients and it was more than 20 dB in 8 (24.2%) patients.

Conclusions: Single stage ossicular reconstruction by incus transposition can lead to improvement of hearing levels of patients with chronic otitis media. Reconstructing the ossicular chain by incus transposition at the time of middle ear surgery has an important role in reducing patients' hospitalization and related costs. (Rawal Med J 2007;32:179-182).

Key Words: Otitis media, ossiculoplasty, hearing loss, incus transposition.
INTRODUCTION

Chronic Otitis Media is a known cause of ossicular erosion that leads to moderate to severe hearing loss. Ossiculoplasty is referred to reconstruction of ossicular chain and it is done six months to one year after primary operation. In recent years, numerous techniques and materials have been used for reconstructing the ossicular chain.\(^1\) Primary work in tympanoplasty was focused on tympanic membrane rather than ossicular chain.\(^2\) Replacement of incus by its own transposition was reported in 1957 for the first time\(^3\) and polypropylene tube was used on incus and under tympanic membrane.\(^4\) Later, incus replacement between malleus and stapes or tympanic membrane was used but had disadvantage of incus translocation which was solved by forming and drilling the incus bone.\(^5\) More recently, various materials have been used in reconstruction of middle ear including synthetic, bony, and cartilaginous materials, hydroxylapatite and Plastipore.\(^6,7\) Although surgeons prefer live autograft bony tissue or cartilage for reconstruction purposes, with AIDS concern in using homograft tissue, it was felt prudent to develop a man made prosthesis that would as nearly as possible match the advantages of living bone.\(^8\) Loss of long process of incus or superior arch of stapes is seen in more than 80% of ossicular chain disruption. It can be due to weak vascularization and its special anatomical position which exposes this ossicle to erosion, atypical cholesteatoma, and posterosuperior perforation.\(^8\) A number of studies have been done to assess the short-term and long-term effects of surgery and ossicular reconstruction on hearing levels of patients with middle ear disease.\(^9-12\) Results depend on degree of disease, experience of surgeons, follow-up period, and number of patients studied. In this study, we wanted to assess the effects of prosthetic synthetic ossicular material by using patient’s own autograft material on multiple hospitalizations and costs related to chronic otitis media. For this purpose, we merged
ossiculoplasty and ossicular reconstruction to evaluate the short-term outcome of single stage ossicular reconstruction in patients with chronic otitis media accompanied by incus erosion.

METHODS
The study sample consisted of 33 patients with chronic otitis media hospitalized in Tabriz Imam Khomeini Hospital, Iran from 2003 to 2004. Patients with chronic otitis media associated with perforated tympanic membrane with lonely incus erosion where steps and malleus were intact, and locally limited cholesteatoma or granulation tissue which could be cleared by canal wall up mastoidectomy were included in the study. We diagnosed incus erosion intraoperatively when looking for ossicular chain discontinuity. Patients with advanced cholesteatoma, canal wall down mastoidectomy, steps erosion, tympanosclerosis, any damage to tympanomeatal flap and treated tympanopasty failure were excluded. All subjects either tympanomastoidectomy or tympanoplasty together with ossicular reconstruction by incus transposition. There was no any interval between the operation and ossicular reconstruction. We used autologous segments of patients' own incus bones. Using a postauricular incision, the incus was removed from the epitympanum by grasping the long process and pulling the body inferiorly. The incus then was remodeled and replaced between the long process of the malleus and the head of the stapes. The operations and ossicular reconstructions were done by an identical surgical team. The patients were discharged from hospital on an average of 48 hours after operation.

We did otolaryngology and audiotympanometry examinations for all subjects before their operation. Postoperative examinations were done on an average follow-up of 13.76±1.23 months. The pre and postoperative audiotympanometry was done by an identical person. Air Bone Gap (ABG) and Speech Reception Threshold (SRT) were calculated pre and postoperatively. We used 500, 1000, and 2000 kHz frequencies for the calculation of ABG.
The data were analyzed by SPSS 14.0 software by paired t-test, independent samples t-test, Fisher's exact probability test and Pearson correlation coefficient. P-value less than 0.05 was considered statistically significant.

RESULTS

There were 33 patients in the study. The ages ranged from 14 to 60 years (mean 32.7±11.59); 13 (39.4%) of them were male and 20 (60.6%) were female. Of 33 patients, 17 (51.5%) underwent tympanoplasty and 16 (48.5%) underwent tympanomastoidectomy. Mean pre and postoperative ABG were 47.27±6.39 and 13.91±7.96 dB respectively (p>0.05). Mean pre 58.06±6.60 and postoperative SRT were 24.27±7.78 dB respectively (p<0.05). There was a significant correlation between postoperative reduction of ABG and SRT (r=0.852; p<0.01).

The relationship between age or sex and reduction in postoperative ABG or SRT was also not statistically significant (p>0.05). Postoperative ABG was less than 20 dB in 25 patients (75.8%) and it was more than 20 dB in 8 patients (24.2%). There was no significant relationship between type of operation and having postoperative ABG less than 20 (p>0.05).

Presence of cholesteatoma was seen in three patients during their operations, and all had postoperative ABG more than 20 dB.

DISCUSSION

Various techniques have been used for treatment of ossicular erosion in chronic otitis media, but there are still controversies in choosing the best method for reconstruction of voice transmission. In 1986, Mikaelian conducted single stage ossicular reconstruction by cartilaginous graft in 18 patients and reached successful results compared to double stage operation.\textsuperscript{13} Siddiq et al. followed surgical results of incus transposition on 23 patients for nine years and two months and declared better results than in short-term follow-up.\textsuperscript{9} Donaldson et al. assessed the long-term hearing results of patients undergoing incus
transposition as a second stage in ossicular reconstruction, following a successful drumhead repair in non-cholesteatoma ears in seventy one patients. They reported that the most successful sub-group was those patients who had a cortical mastoidectomy and silastic sheeting inserted in the first staging procedure.\textsuperscript{14}

A number of studies have compared results of incus transposition and synthetic materials. Sanna et al. state that outcome of incus transposition is more advantageous compared to Plastipore PORP (Partial Ossicular Reconstruction Prosthesis) with or without cartilage during second-stage intact canal wall tympanoplasty.\textsuperscript{15} Furthermore, Nikolaou et al. compared polyethylene TORPs (Total Ossicular Reconstruction Prosthesis) and PORPs, hydroxyl apatite prostheses (TORPs and double notch PORPs), and incus transposition in patients with middle ear disease and reported successful results for PORPs with no statistical difference regarding the hearing improvement, among the different kinds of TORPs.\textsuperscript{10} It has been shown that a rigid mechanical contact between the ossicular prosthesis and ossicles is a prerequisite for effective sound transmission.\textsuperscript{11} The anatomically shaped incus prosthesis gave a 15 dB (deci Bel) improvement on the PORP at frequencies below 1.5 kHz (kilo Hertz).\textsuperscript{11} A one-stage ossiculoplasty with a PORP or TORP has shown that partial ossicular reconstruction prosthesis and total ossicular reconstruction prosthesis entirely made of dense hydroxylapatite yielded high rates of air-bone gap reduction and high anatomical stability in one-stage ossiculoplasty.\textsuperscript{12} Zheng et al. used ossiculoplasties accomplished by a minor columella sculptured in the remnants of the incus placed between the tympanic membrane and stapes head and concluded that this was simple and adequate procedure for primary restoration of hearing in chronic otitis media if the stapes is intact and mobile.\textsuperscript{16}

Our study evaluated short-term results of single stage ossicular reconstruction. ABG reduction (ABG <20 dB) was seen in 75.8% of patients. This shows us the successfulness of single stage operation by incus transposition in a short-term follow-up. The limitation of our
study was a short follow-up period of 13.76±1.23 months. We are following our patients and will assess long term results in few years. All in all, successfullness of autograft materials compared to allograft and homograft ones is clear. Furthermore, single stage ossicular reconstruction can play an important role regarding reducing patients' hospitalization period and also cost-effectiveness of medical services.

REFERENCES


