

Clinical Characteristics of Bilateral Chronic Otitis Media

Jisung Kim, Soo Kyoung Park, Jae Hong Park, Dong Wook Lee, Young-Seok Choi, and See-Ok Shin

Department of Otorhinolaryngology-Head and Neck Surgery, Chungbuk National University College of Medicine, Cheongju, Korea

양측성 만성 중이염의 임상양상

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Address for correspondence

See-Ok Shin, MD, PhD
Department of Otorhinolaryngology-
Head and Neck Surgery,
Chungbuk National University
College of Medicine,
776 Isunhwan-ro, Seowon-gu,
Cheongju 362-711, Korea
Tel +82-43-269-6157
Fax +82-43-265-6157
E-mail soshin@chungbuk.ac.kr

Background and Objectives The purpose of this study was to determine the prevalence of bilateral chronic otitis media (BCOM) and the ratio of unilateral or bilateral cholesteatoma in BCOM. Pre- and post-operative hearing were analyzed to see if bilateral balanced hearing were achieved.

Subjects and Method A retrospective review was done with a computerized otologic database to identify all patients who underwent surgical treatments for COM between 1998 and 2011, and has a follow up duration for at least 6 months. Comparative analysis between pre- and post-operation hearing was measured by pure tone audiometry and achievement of bilateral balanced hearing was analyzed with 'The Belfast rule of thumb'.

Results Two hundred and eighty-one (14.5%) of 1938 patients suffered from BCOM, and of these, 73 (25.9%) of the patients with BCOM had cholesteatomas in one (12.4%) or both ears (13.5%). When a patient with BCOM is found with cholesteatoma in one ear, the odds of there being cholesteatoma in the other ear was 52.1%. According to 'The Belfast rule of thumb', it is considered difficult to achieve successful bilateral hearing gains sufficient for the patients to perceive subjective hearing improvements in BCOM.

Conclusion Approximately 15% of the COM patients were found with the disease in both ears, and the odds of a patient with BCOM having cholesteatoma in one ear also having cholesteatoma in the other ear was 53.4%. It was difficult to achieve subjective, successful and balanced bilateral hearing gain with three-dimensional hearing improvements.

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Key Words Cholesteatoma · Middle ear · Otitis media.

Introduction

Chronic otitis media (COM) is the medical term for long-standing or persistent inflammation of the middle ear. This condition can cause ongoing damage to the middle ear and eardrum, resulting in a perforated eardrum that does not heal or a middle ear infection that does not improve or keeps recurring. COM often produces nonreversible pathologic lesions, including granuloma, cholesteatoma, tympanic sclerosis, and osteomyelitis, in the middle ear cavity.¹⁾ The prevalence of COM varies by country and province and is influenced by intrinsic

factors, such as genetic factors, race and age, and environmental factors, including crowding, economic activities, social and cultural differences.^{2,3)} Kim, et al.³⁾ reported that the prevalence of COM in Korea was 2.19% and 22.8% of the COM patients had cholesteatoma. Similarly, the Fifth Korean National Health and Nutrition Examination Survey reported that the prevalence of COM in Koreans over 4 years old, 19 years old, and 30 years old is 3.0%, 3.5%, and 4.2%, respectively.⁴⁾

Surgery is often indicated to repair the tympanic membrane and remove the infected tissue and pathologic lesions from the middle ear and the mastoid bone.⁵⁾ In cases with bilateral

COM (BCOM), which are not uncommon, it is sometimes difficult to decide whether surgery should be performed, whether surgery should be performed on only one side or on both sides, and which side should undergo surgery first. Typically, the patient's clinical condition, including the presence or absence of unilateral or bilateral cholesteatoma, preoperative audiometric status of both sides and the possibility of hearing improvement or deterioration after surgery, are considered in making these decisions. However, thorough and organized clinical studies on BCOM that can help otologists make the right decisions are lacking, and thus, treatment plans are based largely on surgeons' experiences. In addition, the prevalence of BCOM and the prevalence of cholesteatoma in BCOM have rarely been reported to date.

The authors of this report conducted a retrospective study to determine the prevalence of BCOM and the ratio of unilateral or bilateral cholesteatoma in BCOM and analyzed the results of operations to suggest guidelines on the treatment of BCOM.

Subjects and Method

A computerized otologic database was used to identify all patients who underwent surgical treatments for COM between 1998 and 2011, with at least a 6-month follow-up. The surgeries were performed by the staff at the Department of Otolaryngology-Head and Neck Surgery, Chungbuk National University Hospital, Cheongju, Korea. A retrospective chart review extracted the following information: the distributions of COM with cholesteatoma and COM without it in the patients, the prevalence of unilateral COM (UCOM) and bilateral disease in the cases, and the ratio of unilateral or bilateral cholesteatoma in the BCOM patients.

We analyzed the strategy in terms of the ordering of the ears in the BCOM cases treated bilaterally with sequential surgeries. We also analyzed the preoperative and postoperative audiometric data including air-conduction thresholds and bone-conduction thresholds with a pure tone average (PTA) calculated for 500 Hz, 1000 Hz, 2000 Hz, and 3000 Hz. We also evaluated the hearing improvement or deterioration via a pure tone average air-bone gap (PTA-ABG) calculated for the same frequencies.⁶⁾ Postoperative hearing improvements were calculated as the difference between preoperative bone-conduction and postoperative air-conduction levels. 'The Belfast rule of thumb' was used to evaluate the achievement of bilateral balanced hearing.⁷⁾

Results

During the study period, a total of 1938 patients, including 1977 operated ears, were identified. Of these, 1299 ears (65.7%) had COM without cholesteatoma and 678 (34.3%) had COM with cholesteatoma. In addition, 281 (14.5%) of 1938 patients suffered from BCOM, and of these, 73 cases (25.9% of the patients with BCOM) had cholesteatomas in one (35 cases, 12.4%) or both ears (38 cases, 13.5%) (Fig. 1).

Thirty-nine patients underwent surgical treatments for both ears. Of these, 29 cases had bilateral non-cholesteatomatous COM, 5 cases had non-cholesteatomatous COM in one ear and cholesteatomatous COM in the other ear, and 5 cases had bilateral cholesteatomatous COM. In the cases of bilateral non-cholesteatomatous COM, the worse hearing ear underwent

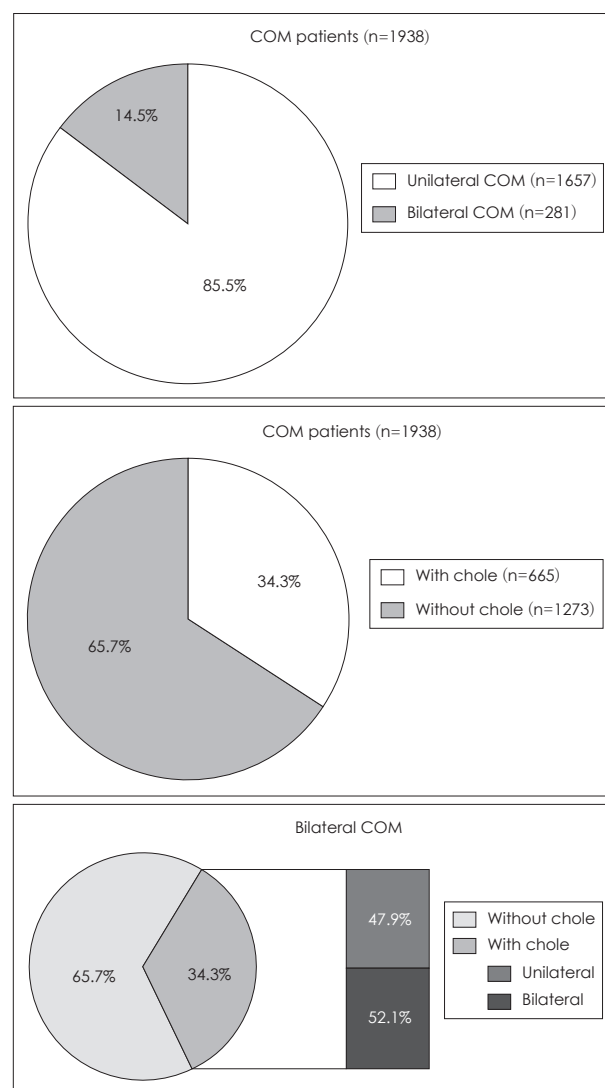


Fig. 1. Characteristics of COM patients. COM: chronic otitis media, chole: cholesteatoma.

operations first if preoperative interaural PTA differences of air-conduction were greater than 10 dB. In cases lesser than 10 dB, the presence or absence of otorrhea, radiologic findings in the middle ear cavities which the preoperative temporal bone computerized tomograms showed and patient preferences were considered in the ordering of ears for the sequential surgeries. Since the hearing of all our 5 cases had better hearing in the non-cholesteatomatous COM ear than the cholesteatomatous COM ear, the ear with cholesteatoma underwent surgery first. In bilateral cholesteatomatous COM cases, operations were first performed on the worse hearing ear. The data indicates that 73 cases of the 281 patients with BCOM had unilateral or bilateral cholesteatomas, with 35 unilateral cases and 38 bilateral cases. From these findings, we found that when the patient has BCOM and there is a cholesteatoma in one ear, the proportion of there being a cholesteatoma in the other ear is 52.1% (38/73).

The analysis of audiometric data in 39 patients treated with bilateral surgeries indicated that the means of the preoperative PTA thresholds were 23.6/55.3 dB (of bone-conduction/ of air-conduction, respectively), the mean of the preoperative PTA-ABGs was 31.6 dB, the means of the postoperative PTA thresholds were 23.7/45.0, the mean of the postoperative PTA-ABGs was 21.7 dB, and the mean of hearing gain was 10.6 dB in the first operated ears. In the second operated ears, the analysis revealed that the means of the preoperative PTA thresholds were 24.5/56.5 dB, the mean of the preoperative PTA-ABGs was 32.0 dB, the means of the postoperative PTA thresholds were 24.5/46.9, the mean of the postoperative PTA-ABGs was 22.3 dB, and the mean of hearing gains was 9.7 dB (Table 1 and 2).

Of these 39 patients, the ears with an air-conduction threshold within 40 dB increased from 8 patients (20.5% of 39) preoperatively to 17 patients (43.5%) postoperatively in the first operated ears. For the second operated ears, these values were 6 patients (15.3%) and 18 patients (46.1%), respectively. The

Table 1. Hearing gain of 1st operated ears in bilaterally operated patients

AC	Number of patients (n=39)	
	Preoperative	Postoperative
<25	3	9
25–40	5	8
40–55	12	6
55–70	13	10
≥70	6	6
Mean AC	55.3±16	45.0±20

AC: air conduction

ears with PTA-ABGs within 20 dB increased from 3 ears (7.7%) preoperatively to 14 ears (35.9%) postoperatively for the first operated ears and from 3 ears (7.7%) to 13 ears (33.3%) for the second operated ears. The data also indicated that 21 of 39 patients (53.8%) had a hearing gain of 10 dB or more after surgeries on the first operated ears, and 19 of 39 patients (48.7%) had gain after operations on the second operated ears (Table 3 and 4).

By applying 'The Belfast rule of thumb', 54% of the cases who had undergone surgeries in both ears presented postoperative interaural differences within 15 dB in air-conduction PTA thresholds, but only 19% of the patients achieved air-conduction PTA thresholds within 30 dB in both ears postoperatively (Fig. 2).

Discussion

After a nation-wide sample survey, Kim, et al.³⁾ reported that the prevalence of COM in Korea was 2.19%. In addition,

Table 2. Hearing gain of 2nd operated ears in bilaterally operated patients

AC	Number of patients (n=39)	
	Preoperative	Postoperative
<25	2	7
25–40	4	11
40–55	15	7
55–70	10	6
≥70	8	8
Mean AC	56.5±16	46.9±19

AC: air conduction

Table 3. Achievement of socially acceptable hearing in 1st operated ears

Hearing evaluation	Number of patients (n=39)	
	Preoperative	Postoperative
AC within 40 dB	8	17
A-B gab within 20 dB	3	14*
Hearing gain of 10 dB or more		21

*postoperative air-conduction–preoperative bone-conduction. AC: air conduction, A-B: air-bone

Table 4. Achievement of socially acceptable hearing in 2nd operated ears

Hearing evaluation	Number of patients (n=39)	
	Preoperative	Postoperative
AC within 40 dB	6	18
A-B gab within 20 dB	3	13*
Hearing gain of 10 dB or more		19

*postoperative air-conduction–preoperative bone-conduction. AC: air conduction, A-B: air-bone

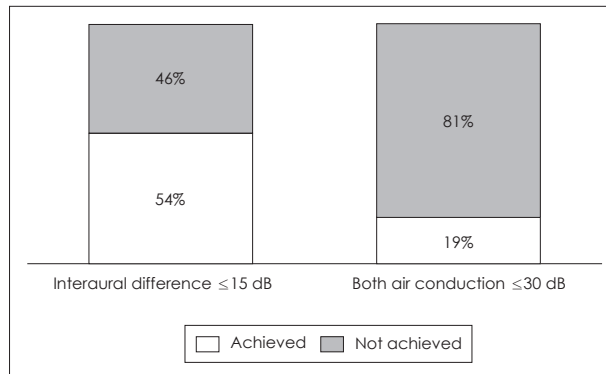


Fig. 2. Achievement of bilateral hearing gains using 'The Belfast rule of thumb'.

22.8% of the COM patients had cholesteatomas, and the prevalence of COM with cholesteatoma was 0.5%. And the the Fifth Korean National Health and Nutrition Examination Survey reported that the prevalence of COM in Koreans over 4 years old, 19 years old, and 30 years old is 3.0%, 3.5%, and 4.2%, respectively.⁴⁾ On the other hand, 678 (34%) of 1977 ears that underwent surgical treatments for COM in the Chungbuk National University Hospital between 1998 and 2011 had cholesteatomatous COM, and this figure is considered to be the result of several factors. One factor is that surgeries are more often indicated and used in the treatment of cholesteatomatous COM than non-cholesteatomatous COM, and another factor is that the patients with cholesteatomatous COM are usually referred to tertiary hospitals such as the Chungbuk National University Hospital because more delicate surgical techniques with a high level of difficulty are needed for the operations involved in treating cholesteatomatous COM.

BCOM cases are not rare in the otologic field. However, the ratio of BCOM in the COM patients has not been previously reported. In this study, 281 (14.5%) cases out of the 1938 COM patients were found to have the disease in both ears. Though this result was not obtained from a nation-wide sample survey but instead from the cases admitted to the hospital, taking a large population of 1938 patients into account, this percentage is considered to be close to the real ratio of BCOM in the COM patients in Korea. The results indicate that 34.3% of COM patients had cholesteatoma and 25.9% of the BCOM patients had cholesteatomas in one or both ears, and this figure was not much different from 22.8%, which was obtained from the aforementioned nation-wide sample survey, representing the ratio of cholesteatomatous COM cases among the whole population of COM patients.

When the patient has BCOM and there is a cholesteatoma in one ear, the proportion of there being a cholesteatoma in the

other ear is 52.1% (38/73). Interestingly, this percentage is much higher than the ratio of cholesteatomatous COM cases among all COM patients from the aforementioned nation-wide sample survey, 22.8%. It is suggested that both ears in a patient can equally share one or more pathogenetic triggering factors known for the development of cholesteatoma, and this may lead to the higher odds found for the 281 patients with BCOM (Fig. 1).

In BCOM, the ordering of ears in sequential surgeries has usually depended on the experiences and decisions of surgeons, and there are no established principles or guidelines associated with this decision. For the authors, it is considered to be a safe strategy that the worse hearing ears undergo operations first because preservation or improvement of hearing is important to the patients and surgeons, and after confirming the preservation or improvement of hearing in the first operated ear, the other ear undergoes surgery. However, when patients with BCOM have unilateral cholesteatomas, the authors have held to the principle that cholesteatomatous ears should undergo operations first because surgeries do not always have a guarantee of hearing preservation, and after ensuring that the hearing of the first operated ears are preserved, surgical treatments are performed in the other non-cholesteatomatous ears. Of course, if the cholesteatomatous ear was the only hearing ear or if it was a markedly better hearing ear, the order of surgery would have changed. In addition, in cases of bilateral cholesteatomatous COM, the authors have conducted surgeries in the worse hearing ears first according to the rule mentioned above that was used for BCOM cases.

Of the patients with BCOM who were treated with bilateral surgeries, 35.9% of the cases had postoperative PTA-ABGs within 20 dB in the first operated ears and 33.3% in the second operated ears, and these values were approximately the same as the results reported by Glasscock, et al.⁸⁾ In addition, 43.5% of the patients displayed socially acceptable hearing postoperatively in the first operated ear if and 46.1% in the second operated ear if we set 40 dB as a socially acceptable hearing level.^{7,9-11)}

When worse hearing ears undergo surgery first, and if those ears do not improve to the point that they are the better hearing ears postoperatively, the subjective hearing gain of the patients with BCOM will not be as great as surgeons believe. For otologists, it is important to evaluate the hearing thresholds of both ears together in cases of BCOM because the degree of hearing impairment mainly depends on the differences of hearing thresholds between the better hearing ears and the

worse hearing ears. Thus, minimizing the degrees of hearing impairment after evaluating hearing thresholds in both ears together is a more rational treatment strategy for producing better hearing improvement results.^{6,10-12)}

It is well known that 'The Belfast rule of thumb'⁷⁾ and 'Glasgow Benefit Plot'⁹⁾ are useful methods in evaluating the results of hearing gain after surgical treatments. According to the 'The Belfast rule of thumb', when patients have air-conduction PTA thresholds within 30 dB in both ears after surgeries or present postoperative interaural differences within 15 dB, the patients are likely to derive significant benefits in hearing improvements. For the Glasgow Benefit Plot, preoperative and postoperative plots of the air-conduction PTA thresholds in both ears are used, and postoperative hearing improvements are evaluated. The authors applied 'The Belfast rule of thumb' to the data in this report and found that only 19% of the patients achieved air-conduction PTA thresholds within 30 dB in both ears postoperatively. The percentage is somewhat poorer compared with those obtained from studies on UCOM, and the varying degrees of severity in ossicular lesions and diversity in surgical treatment methods can explain this difference. In addition, there were only 5 patients with unilateral cholesteatoma and 5 with bilateral cholesteatoma of the 39 bilateral surgical cases. Although a larger study is most likely needed to verify these results, in BCOM cases, it is considered to be difficult to achieve successful bilateral hearing gains sufficient for the patients to perceive subjective hearing im-

provements (Fig. 2).

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