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## Subjective Evaluation and Overall Satisfaction after Tympanoplasty for Chronic Simple Suppurative Otitis Media

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### Abstract

A questionnaire survey was conducted in 324 patients with chronic, simple, suppurative otitis media who had undergone tympanoplasty 6 months or more previously to investigate post-operative hearing, tinnitus, vertigo, occlusive feeling of the ear and otorrhea. In addition, the overall satisfaction with tympanoplasty was assessed by VAS value.

Subjective hearing improvement was observed in 73.1% of the patients whose hearing was poor and in 50% of those whose hearing was good before the operation. The degree of satisfaction assessed by VAS value corresponded with the subjective hearing assessment.

As to tinnitus, 66.2% of the patients became aware of the disappearance or alleviation of symptoms. In the case of patients who had tinnitus before the operation, the degree of awareness of tinnitus and the degree of satisfaction assessed by VAS value coincided. However, no changes in the VAS value were observed in those who did not have tinnitus before the operation.

As for vertigo, 30.5% of the patients who had vertigo preoperatively became aware of the disappearance of the symptoms after the operation. The degree of satisfaction assessed by VAS value corresponded with the presence or absence, severity and frequency of vertigo.

As to the fullness of the ear, alleviation of the symptoms was subjectively noted by 85.9% of the patients who had symptoms before the operation. The degree of satisfaction assessed by VAS value corresponded with the severity of the symptoms in those who had symptoms before the operation.

As for otorrhea, the disappearance of the symptoms was subjectively noted by 85.5% of the patients who had otorrhea before the operation. The degree of satisfaction assessed by VAS value corresponded with the post-operative changes in otorrhea.

Based on the above results, it was assumed that the patients placed greatest expectation on hearing improvement when they underwent tympanoplasty. VAS is considered a useful method to evaluate the degree of satisfaction of patients after surgery.

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**Key words:** chronic simple suppurative otitis media, tympanoplasty, post-operative results, visual analogue scale

## Introduction

Hearing improvements after tympanoplasty are assessed by pure tone audiometry. This is also true in Japan where the Otological Society of Japan proposed new judgment criteria for hearing improvement, and the results have since been assessed according to those criteria. However, assessment based on pure tone audiological criteria does not reflect the satisfaction of patients who have been operated on. Rather, it is the result of surgery evaluated from the standpoint of the physician. In this regard, we conducted a questionnaire survey to investigate the satisfaction of patients with chronic otitis who underwent tympanoplasty. The questionnaire asked the patients about post-operative hearing, tinnitus, vertigo, fullness of the ear and otorrhea. In addition, general satisfaction after tympanoplasty was also determined using a visual analogue scale (VAS), and the results were compared with those obtained from the questionnaire survey.

## Subjects and Methods

A questionnaire survey was conducted from January to July 2002 in the patients who had undergone tympanoplasty 6 months or more previously between 1992 and 2001 at the Otorhinolaryngology Department of Nippon Medical School Hospital, Chiba Hokusoh Hospital affiliated with Nippon Medical School and Yatsu Hoken Hospital. The questionnaires were mailed to the 1,203 patients who were operated on at Nippon Medical School Hospital. At the latter 2 hospitals, the patients were asked to fill in the questionnaire at the time of consultation. It was explained to the patients that their names would never be disclosed even though the results of questionnaires would be used in reports made at academic meetings or in the thesis to be published. The patients were allowed to fill in the questionnaire as they wished. Of the mailed questionnaires, a total of 549 answers (45.6%) were sent back. Fifty-one patients filled in the questionnaire at the time of consultation.

The questionnaire asked the patients any changes

in their hearing, and the presence or absence of tinnitus, occlusive feeling of ear, dizziness, otorrhea, etc. after tympanoplasty. The subjective satisfaction of tympanoplasty was determined by a visual analogue scale (VAS).

Of the 600 patients who responded to the questionnaire survey, 324 with chronic simple suppurative otitis media who underwent initial tympanoplasty were used as the subjects of this study.

As to VAS, a non-graduated 100 mm horizontal line was drawn, whose left end (0 mm) represented "unsatisfied" and right end (100 mm) represented "satisfied", and the degree of overall satisfaction with the tympanoplasty including undergoing the operation, hearing, tinnitus, vertigo, etc. was freely placed as a vertical line across the 100 mm horizontal line. The degree of satisfaction was represented by the length (mm) measured from 0 mm to the placed vertical line.

The post-tympanoplasty results were objectively assessed according to the criteria established by the Otological Society of Japan in 2000<sup>1</sup>. The tympanoplasty techniques were also classified according to the criteria established by the Otological Society of Japan in 2000<sup>2</sup>.  $\chi^2$  test and one factor ANOVA were employed for statistic a processing.

## Results

The 324 subjects included 137 males and 187 females. Their age at the time of the operation ranged from 5 to 75 years old (mean age: 48.8 years old (SD 17.3)).

The most frequently employed surgical technique was tympanoplasty type I (in 242 cases; 74.7%), followed by type III-c (in 57 cases; 17.6%) (**Table 1**).

The patient was considered to have obtained hearing improvement if one or more of the following criteria were satisfied: air-bone gap within 15 dB, hearing gain of 15 dB or more, and hearing level within 30 dB. Of the 324 cases, 269 (83.0%) satisfied one or more of the above criteria, indicating that their hearing had improved.

Concerning the relation between hearing results and surgical technique, type I and type III-c were successful in 210 cases (86.8%) and 50 cases (87.7%),

respectively, both of them demonstrating a significant difference ( $p < 0.0001$ ) from the results achieved with type IV-c and WO (tympanoplasty without ossiculoplasty) when assayed by  $\chi^2$  test.

The 320 patients (98.8%) answered the question about hearing. The pre-operative hearing was determined with feeling of the patient in the case. Cases in which the patients felt before the operation that their hearing was poor were entered in the "Poor hearing before operation" column, and cases in which the patients felt before the operation that their hearing was good were entered in the "Good hearing before operation" column. The pre-operative hearing level was 47.3 dB (SD 19.7) in the cases in which the

patients felt that their hearing was poor, and 44.2 dB (SD 22.7) in the cases in which the patients felt that their hearing was good, which indicated no difference between them.

The hearing level was "poor" in 298 patients (93.1%) and "good" in 22 patients (6.9%) before the operation; after the operation, 218 (73.1%) of the 320 patients answered "hearing is much improved" or "somewhat improved", while 11 (50%) of the 22 patients answered "hearing is much improved" or "somewhat improved". Including those who answered "no change", 18 patients (81.8%) were satisfied with their post-operative hearing (**Table 2**).

Concerning tinnitus, answers were obtained from 317 patients (97.8%). Tinnitus was present before the operation in 151 patients (47.6%) but disappearance and improvement of the symptoms were observed in 37 and 63 patients, respectively after the operation, indicating an improvement was obtained in 100 patients (66.2%). On the other hand, tinnitus worsened in 12 patients (7.9%). Of the 166 patients who did not have tinnitus before the operation, no change was obtained in 120 (72.3%) but the remaining 46 (27.7%) showed some degree of tinnitus after the operation (**Table 3**).

Concerning vertigo, 305 patients (94.1%) answered the question. Vertigo was present before the operation in 82 (26.9%) and was absent in 223 (73.1%). The pre-operative vertigo disappeared after the

Table 1 Satisfaction by surgical technique of tympanoplasty

Surgical technique	Number of cases	Satisfaction (mm)	S.D.
1. type I	242	81.1	22.2
2. type III-c	57	74.5	26.5
3. type IV-c	9	75.5	32.4
4. WO	16	76.6	25.1

Expressed satisfaction in VAS. A value of VAS satisfied 100mm that 0mm are unsatisfied.

There were no statistical differences in the overall satisfaction (VAS) by surgical technique.

type III-c: type III with columella

type IV-c: type IV with columella

WO: tympanoplasty without ossiculoplasty

Table 2 Subjective hearing and overall satisfaction after the operation

a. Poor hearing before the operation	Number of cases	Satisfaction (mm)	S.D.
1. Much improved	120	92.3	10.8
2. Somewhat improved	98	79.9	17.2
3. Unchanged	62	66.4	27.8
4. Somewhat worsened	9	46.7	29.7
5. Considerably worsened	9	37	31.7
b. Good hearing before the operation	Number of cases	Satisfaction (mm)	S.D.
1. Much improved	4	97.5	3.3
2. Somewhat improved	7	65.9	19
3. Unchanged	7	75.1	29.2
4. Somewhat deteriorated	3	51.1	46
5. Considerably deteriorated	1	52	

As to the patients whose pre-operative hearing was poor, a significant difference was observed between 1 and 2, 1 and 3, 1 and 4, 1 and 5, 2 and 3, 2 and 4, 2 and 5, 3 and 4, and 3 and 5 ( $p < 0.01$ ).

As to the patients whose pre-operative hearing was good, a significant difference was observed between 1 and 4 ( $p < 0.05$ ).

Table 3 Changes in subjective tinnitus and overall satisfaction after the operation

a. Presence of tinnitus before the operation	Number of cases	Satisfaction (mm)	S.D.
1. Disappeared	37	88.7	14.8
2. Alleviated	63	84.7	19.1
3. Unchanged	39	69.3	23.6
4. Became somewhat louder	9	59.4	30.7
5. Became louder	3	41	39.5
b. Absence of tinnitus before the operation	Number of cases	Satisfaction (mm)	S.D.
1. No tinnitus	120	82	23.5
2. Mild tinnitus sometimes	29	73.1	27.4
3. Loud tinnitus sometimes	3	78.3	15
4. Mild tinnitus always	11	71.6	23
5. Loud tinnitus always	3	82.7	28.3

As to the patients who had tinnitus before the operation, a significant difference was observed between 1 and 3, 1 and 4, 1 and 5, 2 and 3, 2 and 4, 2 and 5, 3 and 5 ( $p < 0.02$ ).

Table 4 Subjective changes in vertigo and overall satisfaction after the operation

a. Presence of vertigo before the operation	Number of cases	Satisfaction (mm)	S.D.
1. Completely disappeared	25	85.6	14.7
2. Alleviated	36	75.2	23.7
3. Unchanged	17	63.6	33.5
4. Some increase in the frequency of vertigo	2	49	0
5. Increase in the frequency of vertigo	2	91.7	10.2
b. Absence of vertigo before the operation	Number of cases	Satisfaction (mm)	S.D.
1. Unchanged	209	81.9	22.9
2. Came to have vertigo a few times	6	65.7	36.1
3. Came to have vertigo sometimes	8	69.4	20.1
4. Came to have vertigo frequently			
5. Came to have vertigo always			

As to the patients who had vertigo before the operation, a significant difference was observed between 1 and 3, and 1 and 4 ( $p < 0.05$ ).

operation in 25 patients (30.5%) and worsened in 4 (4.9%). No change was observed in 209 (93.7%) of those who did not have vertigo before the operation but 14 (6.3%) had vertigo after surgery (**Table 4**).

As for fullness of the ear, 307 patients (94.7%) responded the question. The symptoms were present before the operation in 156 patients (50.8%), and absent in 151 patients (49.2%). This pre-operative fullness of the ear "completely disappeared" in 57 (36.5%) and "somewhat remained" in 77 (49.3%) after the operation. On the other hand, worsening of the symptoms occurred in 7 patients (4.5%). As to the 113 patients who did not have the fullness of the ear before the operation, 113 (74.8%) patients showed

"no change" while the symptoms newly appeared in 38 (25.2%) (**Table 5**).

Concerning otorrhea, 318 patients (98.1%) answered the question (**Table 6**). Otorrhea was present before the operation in 241 patients (75.8%) and absent in 77 (24.2%). After the operation, otorrhea disappeared in 206 patients (85.5%) and persisted in 35 (14.5%). According to the investigation based on the charts, there was no case of re-perforation and the eardrum was dry in most of the cases. As to the patients who did not have otorrhea before the operation, 73 (94.8%) did not complain of otorrhea postoperatively and 4 (5.2%) complained of otorrhea. According to the investigation based on the charts,

Table 5 Changes in fullness of the ear and overall satisfaction after the operation

a. Presence of fullness of the ear before the operation	Number of cases	Satisfaction (mm)	S.D.
1. Completely disappeared	57	87.4	15.6
2. Some remained	77	80.4	19.7
3. Unchanged	15	59	19.2
4. Worsened somewhat	4	54	22.7
5. Became considerably worse	3	35	56.3
b. Absence of fullness of the ear before the operation	Number of cases	Satisfaction (mm)	S.D.
1. Unchanged	113	82.8	22.8
2. Came to have fullness of the ear a few times	10	73.7	28.5
3. Came to have fullness of the ear sometimes	9	84	14.1
4. Came to have fullness of the ear frequently	1	62	
5. Came to have fullness of the ear always	18	72.1	30.6

As to the patients who had fullness of the ear before the operation, a significant difference was observed between 1 and 2, 1 and 3, 1 and 4, 1 and 5, 2 and 3, 2 and 4, and 2 and 5 ( $p < 0.04$ ).

Table 6 Presence or absence of subjective otorrhea and overall satisfaction after the operation

a. Presence of otorrhea before the operation	Number of cases	Satisfaction (mm)	S.D.
1. Completely disappeared	206	82.7	20.2
2. Remained but the amount and frequency decreased	32	73.2	31.5
3. Unchanged	2	83.5	13.4
4. The amount and frequency increased somewhat	1	49.5	
5. Both the amount and frequency increased			
b. Absence of otorrhea before the operation	Number of cases	Satisfaction (mm)	S.D.
1. Unchanged	73	74.8	3
2. Came to have otorrhea a few times	1	75	
3. Came to have otorrhea sometimes	3	56	29.1
4. Came to have otorrhea frequently			
5. Came to have otorrhea always			

As to the patients who had otorrhea before the operation, a significant difference was observed between 1 and 2 ( $p < 0.03$ ).

there was no re-perforation of the eardrum, but mild myringitis was observed.

The overall satisfaction with the tympanoplasty was indicated by the VAS value whose assessment range is from 0 mm (unsatisfied) to 100 mm (satisfied). The mean VAS value was 79.6 (SD 23.5) mm. As to the relation between hearing results and satisfaction, the VAS values were 82.5 mm in successful cases and 65.3 mm in unsuccessful cases, indicating a significant difference between the two groups ( $p < 0.0001$ ). However, when satisfaction was investigated by surgical technique, type I was rated as 81.3 mm while WO was rated as 77.7 mm, indicating no difference according to type of surgical technique (Table 1).

Regarding the relation between hearing and satisfaction, the VAS value was high in the patients who answered "much improved" while it was low in those who answered "considerably deteriorated". As shown in Table 2, a significant difference was observed among those whose hearing was poor before the operation.

As for the relation between tinnitus and satisfaction, the VAS value was 84 mm or more in the patients whose pre-operative tinnitus disappeared or decreased after the operation. On the other hand, the VAS value was 60 mm or less in those whose tinnitus worsened. As to the patients who did not have tinnitus, preoperatively the VAS value was

82.0 mm in those who answered “no change” while it was 82.7 mm in those who indicated the presence of “usual big tinnitus”, indicating small changes in VAS values (**Table 3**).

Concerning the relation between vertigo and satisfaction, the VAS value was 85.6 mm in those whose vertigo “completely disappeared” and 91.7 mm in those in whom vertigo “occurred more frequently” after the operation. In other words, the status of vertigo did not always correspond with the level of satisfaction. The VAS value in the patients who did not have vertigo before the operation was 81.9 mm in those who answered “no change” and 69.4 mm in those who “came to have vertigo sometimes”, indicating no difference between the two groups (**Table 4**).

As for the relation between fullness of the ear and satisfaction, the VAS value in the patients in whom the feeling of numbness “completely disappeared” or “somewhat remained” was 80 mm or more while it was 35.0 mm in those who had the “fullness of the ear all the time”, indicating a significant difference between the two groups. No difference attributable to post-operative changes was observed in the patients who did not have the symptoms before the operation (**Table 5**).

Regarding the relation between otorrhea and satisfaction, the VAS value in the patients in whom the otorrhea “completely disappeared” was 82.7 mm and in those in whom it “still remained but the amount and frequency decreased”, the VAS value was 73.2 mm, indicating a significant difference between the two groups. In the patients who did not have otorrhea before the operation, there was no difference between those who did not have otorrhea and those who did after the operation (**Table 6**).

### Discussion

The post-operative results of chronic otitis patients are assessed by pure tone audiometry<sup>3-7</sup>. The Otological Society of Japan proposed new hearing gain assessment criteria in 2000 that set the hearing level within 30 dB. Since then, hearing has been assessed in accordance with those criteria. However, the criteria are for the post-tympanoplasty hearing gain assessment based on pure tone audiometry and

they focus on the hearing level but they do not reflect the satisfaction expressed by the patient. In addition to arresting otorrhea, tympanoplasty is expected to improve hearing, vertigo and fullness of the ear as well as to reduce tinnitus. In the case of patients with chronic, simple, suppurative otitis media, much expectation is placed on the arrest of otorrhea and improvement of hearing.

In the present study, the subjective assessment of hearing gain after the operation corresponded with the satisfaction of the patients whose hearing was poor before the operation. This seems to reflect the great expectation regarding hearing gain after surgery by those whose pre-operative hearing was “poor”. However, except for those who answered “much improved”, the post-operative hearing assessment did not coincide with the level of satisfaction in the patients whose pre-operative hearing was “good”, suggesting that these patients expected something more than hearing improvement.

There have been only a few reports on subjective hearing after tympanoplasty. Aihara et al.<sup>8</sup> conducted a questionnaire survey in patients who underwent tympanoplasty to investigate their satisfaction with the operation results. As to post-operative hearing, they reported that the hearing result did not coincide with the subjective assessment because, even though hearing gain was noted using the hearing test in 89% of the patients, only 63.2% of them became aware of the improved hearing, probably because of the substantial influence of those whose hearing was also good before the operation. Sheahan et al.<sup>9</sup> investigated 62 ears of children who underwent type I tympanoplasty. They reported that surgical success was observed in 72.5% of them, that 50% of the parents acknowledged improved hearing and that 79% of the parents were satisfied with the overall results. These results were indicated by the parents and therefore did not completely coincide with the satisfaction of the patients themselves, but the assessment was made from the standpoint of patients. In the present study, the VAS value was 90 mm or more in those whose hearing was “much improved” regardless of their hearing level before the operation. In other words, the subjective hearing gain after the operation coincided with the satisfac-

tion with the operation. However, the number of patients who became aware of "improved hearing" after the operation was 229 (71.6%), which did not coincide with the successful rate of 83.0% obtained from the hearing test. Probably, this difference is attributable to the rule to assess the hearing result as successful if any of the assessment criteria is satisfied.

As to the relation between tinnitus and satisfaction, improvement was observed in 66.2% of the 151 patients. The satisfaction expressed by the patients corresponded with the improvement in tinnitus. Saito et al.<sup>10</sup> performed an operation to improve hearing in 2 patients whose major complaint was tinnitus and reported that tinnitus disappeared in both of them. However, because of the small number of cases investigated, the result is not considered to apply to all the patients with chronic otitis media that have tinnitus. Although the duration was as short as up to 3 weeks after tympanoplasty, Takeno et al.<sup>11</sup> objectively assessed tinnitus. This disappeared or was alleviated in 7 of their 10 patients who had low or intermediate tinnitus and in 5 of their 20 patients who had severe tinnitus before the operation. Although it has generally been considered that no change occurs in tinnitus after tympanoplasty, these results and reports do not support the conventional concept. The mechanism of onset of tinnitus as a complication of chronic otitis media is unknown but recovery from tinnitus attributable to the conductive system of the middle ear may be expected after tympanoplasty. On the other hand, as for the patients who had no pre-operative tinnitus but who came to have tinnitus after the operation, there was no difference in their level of satisfaction compared to that of those who experienced no change. The result seems to indicate that patients who had pre-operative tinnitus placed much expectation on the improvement of tinnitus after the operation.

Regarding the relation between vertigo and satisfaction, the frequency of vertigo and satisfaction considerably corresponded regardless of the presence or absence of pre-operative vertigo, indicating that the patients placed much expectation on the improvement of vertigo after the operation.

Concerning the relation between the fullness of

the ear and satisfaction, the level of satisfaction was high in the patients whose symptoms improved after the operation. Depending on the severity of the symptoms, there were differences in the degree of satisfaction. The post-operative onset and severity of the symptoms did not coincide with the degree of satisfaction in the patients who did not have the symptoms before the operation.

As to the relation between otorrhea and satisfaction in the patients who had otorrhea before the operation, a significant difference in the degree of satisfaction was observed between those whose otorrhea "completely disappeared" and those whose otorrhea "still remained but the amount and frequency decreased", indicating that the degree of satisfaction increased with the disappearance of otorrhea. The primary purpose of the operation for chronic, simple, suppurative otitis media is to close the eardrum perforation and to arrest otorrhea. The results of this study also indicated that the patients placed much expectation on the arrest of otorrhea.

Another purpose of tympanoplasty is, if possible, to reconstruct the conductive system. According to the results of this study, the highest degree of satisfaction was observed with hearing gain, followed by the arrest of otorrhea and improvement of tinnitus, in this order. These results indicated that the patients expected tympanoplasty to improve their hearing rather than to arrest otorrhea. According to the overall assessment of tympanoplasty by VAS, the values were in correspondence with the subjective assessment of hearing, tinnitus, vertigo, occlusive feeling of ear, otorrhea, etc., indicating that VAS is useful as an index of subjective post-operative assessment.

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