Secondary Otalgia in an Adult Population

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Objective: To analyze the associations of secondary otalgia with general health, stress, insomnia, bruxism, and recurrent head and neck region pains.

Design: A population-based survey.

Setting: General community.

Subjects: A total of 391 randomly selected subjects (186 men, 205 women) aged 25, 35, 45, 55, or 65 years.


Results: Otalgia was statistically significantly associated with all the studied factors. However, in the whole study group, independent predictors of otalgia were the obvious need for temporomandibular disorder treatment, high frequency of stress symptoms, and bruxism. When analyzed in women, the predictors of otalgia were the obvious need for temporomandibular disorder treatment, high frequency of stress symptoms, and age. When analyzed in men, recurrent neck pain was a predictor of otalgia.

Conclusions: We suggest that after ruling out otorhinolaryngologic infectious diseases and temporomandibular disorder in patients with secondary otalgia, the next step is to explore the frequency of stress symptoms, bruxism, and recurrent neck pain. Furthermore, women and men may need a different approach in diagnostics of secondary otalgia. By diagnosing and treating these predictors of otalgia, it may be possible to reach a more successful outcome.


PAIN RESULTING from a pathologic condition of the ear is called primary otalgia. It is most frequently caused by infectious diseases in the ear, such as otitis media. Other causes of primary otalgia are tumor and trauma. However, according to Paparella and Jung, about half of the patients with otalgia have some other reason for aural pain, called secondary otalgia. Secondary otalgia may arise from diseases in the paranasal sinuses, nose, and pharynx or, frequently, from temporomandibular disorder (TMD). In the study by Leonetti et al, the most common cause of referred otalgia in patients whose chief complaint was otalgia with a normal-appearing ear was dental (74%). Furthermore, the cause of secondary otalgia can also be referred pain from the mouth, teeth, larynx, or thyroid gland; neural, vascular, or lymphatic structures of the neck; or the esophagus, heart, or lungs.

According to our previous report, in a random adult population, the prevalence of otalgia without infection varied from 12% to 16% during a 2-year follow-up. It was more prevalent in the subjects with an obvious need for treatment of TMDs than in the others and closely associated with palpatory tenderness of the lateral pterygoid and posterior digastric muscles and the temporomandibular joint.

The purpose of this study was to examine, in an adult population, the associations of secondary otalgia with general disease, stress symptoms, insomnia, bruxism, and head and neck region pains and the power of these factors to predict otalgia, together with age, sex, and need for TMD treatment.

The prevalences of the studied variables in the study population are as follows:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Prevalence, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Otalgia</td>
<td>12.5</td>
</tr>
<tr>
<td>General disease</td>
<td>43.7</td>
</tr>
<tr>
<td>Any sleeping problem</td>
<td>57.5</td>
</tr>
<tr>
<td>Any bruxism</td>
<td>30.7</td>
</tr>
<tr>
<td>Any recurring pain</td>
<td>54.2</td>
</tr>
<tr>
<td>Total stress score</td>
<td>&gt;120</td>
</tr>
</tbody>
</table>

The mean age of subjects with otalgia was 45.4 years, and the mean age of those without otalgia was 47.4 years. The prevalence of otalgia increased with age...
SUBJECTS AND METHODS

A total of 513 subjects, 246 men and 269 women, born in the years 1927, 1937, 1947, 1957, or 1967, participated in a 2-year follow-up study (March 1992 to November 1993) of TMD and related symptoms. The sample was randomly drawn from the records representing the population of the municipality of Jyväskylä, Finland. The present report is based on 391 subjects (186 men, 205 women) who participated in all 3 consecutive examinations and interviews, completed a self-report questionnaire at 12-month intervals, and were not treated for stomatognathic reasons. An experienced clinician (M.H.K.) performed all the clinical examinations and interviews. Informed consent was obtained from subjects before participation in the study. The study was approved by the ethical committee of the Central Hospital in the Province of Middle Finland. A more detailed description of the sample and clinical examinations has been published previously.6

After clinical examination, subjects were interviewed using standardized questions for symptoms related to TMD. One question was asked about whether otalgia, defined as pain in or around the ear that was not associated with infections or otitis, had occurred during the last month. The interview also included 3 questions about insomnia, bruxism, and recurrent head and neck region pains during the preceding month. Bruxism reported in the interview was used in analyses and no clinical criteria were used. General health was assessed with a standardized self-report formula. The severity and disability of otalgia were not estimated.

The frequency of physical, behavioral, and psychological stress symptoms was assessed with the Symptoms of Stress Inventory, which is derived from the Cornell Medical Index.3 The reliability and validity of the Symptoms of Stress Inventory and its use as a screening instrument have been shown in both American and Finnish studies.7-8

For treatment need analyses of TMDs, the classification system by Kuttita et al was used. The classification was based on anamnestic data, clinical and radiologic findings, and clinician’s judgment. Subjects in the active treatment need subgroup had moderate or severe signs and subjective symptoms of TMDs, prompting them to seek help or designating them as needing care independently of other possible oral health problems (ie, TMDs alone require treatment). Subjects in the passive treatment subgroup showed some minor signs or symptoms of TMDs, but were assessed as needing no stomatognathic treatment if no other dental care was considered necessary. Subjects were classified into the no treatment need subgroup if TMD problems did not require treatment in any circumstances.

The chi-square test was used in analyses of associations of otalgia with general disease, sleep problems, bruxism, and head and neck region pain. The Student t test was used in comparing means of age, number of general diseases, and total stress scores between subjects with otalgia and those without. Stepwise binomial logistic regression analysis (SPSS 10.0, SPSS Inc, Chicago, Ill) was used to find independent predictors of otalgia. The differences in the occurrence of the studied variables were considered as statistically not significant if \( P > .05 \), almost significant if \( .05 > P > .01 \), significant if \( .01 > P > .001 \), and highly significant if \( P < .001 \).

from 10.6% in the 25-year-old age group to 19.7% in the 55-year-old age group and thereafter decreased to 8.9% in the 65-year-old age group. Women reported otalgia almost twice as often as did men (16.0% vs 8.6%; \( \chi^2=4.8, P=.03 \)). The same sex difference in prevalence of otalgia was present in all age groups, but no statistical significance was revealed, probably because of the small sample sizes.

The prevalence of general disease in the whole study group was 43.7%. It was 1.4 times more prevalent in the subjects with otalgia than in those without otalgia (57.1% vs 42.9%; \( \chi^2=4.1, P=.04 \)). The mean number of general diseases was almost 2-fold in subjects with otalgia compared with those without otalgia (1.0 vs 0.6; \( F=12.0, P=.001 \)). However, among subjects with otalgia, only 1 in 4 had more than 1 general disease. The subjects with otalgia in general did not have more specified diseases than those without, with the exception of general arthritis and cardiovascular disease (Table 1).

In the whole study group, the mean total score of stress symptoms was 75.7 (men, 71.0; women, 80.1; \( F=5.0, P=.03 \)). The subjects with otalgia had higher mean stress scores than those without otalgia (100.1 vs 72.3; \( F=20.9, P<.001 \)), and 38.8% of them had a total stress score higher than 120 compared with 10.5% of subjects without otalgia (\( \chi^2=28.3, P<.001 \)). The subjects with secondary otalgia more often had sleep problems than those without otalgia. Not falling asleep was reported 1.3 times, waking up more often than once a night was reported 1.9 times, and waking up in pain was reported 3.2 times as often in subjects with otalgia as in those without otalgia (Figure 1). The difference was highly significant in waking up more often than once a night (\( \chi^2=13.4, P<.001 \)) and almost significant in not falling asleep (\( \chi^2=5.8, P=.02 \)) and waking up in pain (\( \chi^2=6.6, P=.01 \)).

The prevalence of nocturnal bruxism was 20%; diurnal bruxism, 7%; and both bruxisms, 4%. Bruxism was reported 1.8 times as often by subjects with otalgia as those without otalgia (Table 2). Compared with men, women more often reported any symptom of bruxism, a finding that was statistically significant (37.9% vs 22.7%; \( \chi^2=10.3, P=.001 \)).

In subjects with otalgia, the prevalence of head and neck region pains recurring twice a month or more often were higher in subjects with otalgia than those without: headache was 2.7 times, neck pain 1.7 times, and shoulder pain 1.6 times as prevalent as in subjects without otalgia (Figure 2). The differences were statistically significant (headache, \( \chi^2=18.7, P<.001 \); neck pain, \( \chi^2=13.9, P<.001 \); and shoulder pain, \( \chi^2=11.3, P=.001 \)).

When the studied variables were analyzed together by binomial stepwise logistic regression analysis, the independent predictors of secondary otalgia were active need for TMD treatment, total stress symptom score of more than 120, and bruxism (Table 3). The final model cor-
Directly classified 88.2% of subjects overall. However, when the regression analysis was carried out separately for men and women, the final model differed. In men, the final model included recurrent neck pain, and in women, it included active need for TMD treatment, total stress symptom score of more than 120, and the 55-year-old age group. In men, the final model correctly classified 91.9% of subjects, and in women, 85.0% of subjects.

**COMMENT**

Our previous report analyzed the associations of otalgia with signs and symptoms of TMD and visits to a physician due to otalgia in a random adult population. It was based on a 2-year longitudinal study of 411 subjects and the first study to report the prevalence of otalgia without infection in an adult population (12%-16%). The present study is based on the same study group, but the subjects who did not complete the stress questionnaire (n=20) were excluded from the analysis. The subjects and participation of the study group have been discussed in detail previously.

The study population was as healthy as Finns in general. The reported prevalences of general disease and recurrent neck pain were in line with the studies by Aromaa et al, Mäkela et al, and Takala et al. The prevalence of recurrent headache in our study was lower than that reported by Honkasalo et al and Sillanpää, and the prevalence of recurrent shoulder pain in our study was higher than reported by Takala et al and Mäkela et al. However, in Swedish studies by Ekberg et al and Westerling and Jonsson, prevalences of shoulder symptoms were much more in line with our study. The total prevalence of bruxism in our study is almost the same as in the study by Goulet et al, 31% and 26%, respectively. However, daytime and nighttime prevalences were just the opposite between the studies: our figures were 11% and 24% compared with 20% and 6%, respectively, in the study by Goulet et al. In summary, our prevalence figures of general disease, recurrent pain in the head and neck region, and bruxism may not be overestimates but rather the result of different methods and criteria.
In the present study, 58% of subjects reported some sleeping problem. This is higher than the 35% in the study by the National Institute of Mental Health, but in line with the figures of TMD patient studies by Fricton et al and Harness et al. In our study, the subjects with otalgia without infection reported sleep problems more often than those without otalgia. In TMD patients, according to the study by Fricton et al, sleep problems are associated with myofascial pain, and so one could expect that sleep problems also increase the intensity, duration, or handicap of secondary otalgia. To summarize, in patients with secondary otalgia, the amount and quality of sleep should also be evaluated and treated along with other symptoms.

Beaton et al have used a cutoff point of 100 points of the total stress score to determine which American patients with TMD would benefit from further psychological consultation. The screening point of 120 has been suggested for Finnish patients and subjects with TMD. In the follow-up study of an adult population by Kutttila, 32% to 49% of the subjects with obvious need for treatment of TMD had a total stress symptom score of 120 points or more. In the present study, 39% of subjects with otalgia had a total stress symptom score of 120 or higher, suggesting that these subjects might also benefit from psychological assessment and consultation.

Many theories suggest that stress is one of the factors making occasional bruxism occur more frequently and overload the temporomandibular joint and masticatory muscles, causing pain that can be referred to the ear. This could explain why individuals with an elevated level of stress symptoms experience otalgia more often than those with a lower stress level. The findings of our earlier report support these theories: subjects with an active need for TMD treatment had higher stress levels and more secondary otalgia than those without. In the present study, the prevalence figures for bruxism were based on interview and not on clinical examination. Therefore, our figures may underestimate the prevalence of bruxism. This underestimation does not, however, necessarily affect the revealed association between secondary otalgia and bruxism.

Concerning sex, regression analysis revealed that women with otalgia seem to have elevated frequency of stress symptoms, have an obvious need for TMD treatment, and belong in the 55-year-old age group. In men with otalgia, recurrent neck pain was the only independent predictor of otalgia. Consequently, diagnosing and treating otalgia may require a different approach in men than women. Further investigations are required to identify what kind of stress symptoms best predict otalgia: is secondary otalgia associated with the occurrence of multiple symptoms in different organ systems or is otalgia the result of few but frequently occurring symptoms specifically located in the head and neck region?

In our earlier report, the association of otalgia with TMD was explained as referred pain from the lateral pterygoid, deep masseter muscle, or temporomandibular joint. We concluded that it is important to first rule out infectious otologic and nasopharyngeal diseases in patients with otalgia and thereafter refer the patient to a stomatognathically experienced dentist to rule out stomatognathic causes of aural pain. According to this study, the next step is to explore the frequency of stress symptoms, bruxism, and recurrent neck pain.

### Table 3. Final Models of Binomial Variables Predicting Secondary Otalgia by Stepwise Logistic Regression Analysis in the Whole Study Group, Men, and Women

<table>
<thead>
<tr>
<th>Variable</th>
<th>Whole Study Group (N = 391)</th>
<th>Men (n = 185)</th>
<th>Women (n = 206)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active need for TMD treatment</td>
<td>3.75 (1.57-8.96)</td>
<td>1.78 (0.32-9.73)</td>
<td>4.78 (1.61-14.19)</td>
</tr>
<tr>
<td>Total stress score &gt;120</td>
<td>3.26 (1.50-7.06)</td>
<td>2.90 (0.65-12.99)</td>
<td>3.97 (1.50-10.51)</td>
</tr>
<tr>
<td>Recurrent neck pain</td>
<td>2.56 (0.63-10.40)</td>
<td>10.65 (1.56-72.57)</td>
<td>0.79 (0.11-5.84)</td>
</tr>
<tr>
<td>Any type of bruxism</td>
<td>2.19 (1.07-4.50)</td>
<td>3.32 (0.94-11.71)</td>
<td>1.84 (0.71-4.81)</td>
</tr>
<tr>
<td>Age group of 55 years</td>
<td>1.99 (0.90-4.40)</td>
<td>0.63 (0.14-2.80)</td>
<td>4.01 (1.38-11.64)</td>
</tr>
<tr>
<td>Recurrent headache</td>
<td>1.68 (0.78-3.66)</td>
<td>1.09 (0.22-5.46)</td>
<td>2.32 (0.90-5.98)</td>
</tr>
<tr>
<td>Any sleep problem</td>
<td>1.51 (0.71-3.20)</td>
<td>2.15 (0.52-8.98)</td>
<td>1.42 (0.54-3.89)</td>
</tr>
<tr>
<td>Female sex</td>
<td>1.33 (0.64-2.76)</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>General disease</td>
<td>1.02 (0.50-2.05)</td>
<td>0.56 (0.17-1.89)</td>
<td>1.34 (0.52-3.44)</td>
</tr>
<tr>
<td>Recurrent shoulder pain</td>
<td>0.76 (0.29-2.33)</td>
<td>0.23 (0.04-1.56)</td>
<td>2.60 (0.36-19.00)</td>
</tr>
</tbody>
</table>

* The power of predicting otalgia is expressed as odds ratio (OR) (the ratio of otalgia when variable is 1 to the same odds when variable is 0) at 95% confidence interval (CI). The statistically significant ORs in the models are indicated in boldface. TMD indicates temporomandibular disorder.

**CONCLUSIONS**

When analyzed separately, the results showed an association between otalgia and all the studied factors. However, the independent predictors of otalgia were an active need for TMD treatment, an elevated level of stress symptoms, and bruxism. The final models of the predictors of otalgia for men and women differed. Women and men may, hence, need a different approach in diagnostics and treatment of secondary otalgia. We suggest that in patients with otalgia, it is important to first rule out infectious otologic and nasopharyngeal diseases that may cause aural pain. Thereafter, the patient should be referred to a stomatognathically experienced dentist to rule out stomatognathic causes of otalgia. If no stomatognathic cause of otalgia can be found, the next step is to explore the frequency of stress symptoms, bruxism, and recurrent neck pain.
recurrent neck pain. By diagnosing and treating the predictors of otalgia, it may be possible to achieve a more successful outcome in secondary otalgia.

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