



ORIGINAL ARTICLE

Clinical implications of iatrogenic lesion in the chorda tympani nerve during otosclerosis surgery

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KEYWORDS

Chorda tympani nerve;
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Dysgeusia;
Taste disorders

Abstract

Introduction: Damage to the chorda tympani nerve is frequent during otologic surgery. This article studies the clinical outcomes of the nerve's section versus its conservation in otosclerosis surgery.

Material and method: Retrospective observational study using our department's otosclerosis database and a validated questionnaire on symptoms associated with the chorda tympani nerve. The sample was divided into 2 groups: section and conservation (patients whose nerve was anatomically conserved). We studied the presence and duration of symptoms, the surgical technique, and the audiometric results.

Results: Seventy-eight patients (88 ears): section group (18 ears; 20%) and conservation group (70 ears; 80%). Overall, gustatory symptoms appear in 35% (39% section group; 34% conservation group). Differences between groups are not statistically significant in relation to presence and duration of symptoms, surgical technique, or audiometric results. Only 1 patient in each group reports long-term symptoms. Our results suggest there are no major clinical differences following section versus conservation of the chorda tympani nerve. A wide range of factors such as age, presence of previous middle ear pathology, cross innervation, and gastronomic culture may play a role in the appearance of symptoms.

Conclusions: Symptoms appearing after iatrogenic damage to the chorda tympani nerve have, in general, little clinical relevance, especially in the long term, regardless of whether the nerve is dissected or manipulated to various degrees.

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PALABRAS CLAVE

Cuerda del tímpano;
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Disgeusia;
Alteración del gusto

Implicación clínica de la lesión iatrogénica de la cuerda del tímpano en la cirugía de la otosclerosis

Resumen

Introducción y objetivos: La lesión de la cuerda del tímpano en cirugía otológica es frecuente. Este trabajo pretende estudiar las repercusiones clínicas de la sección contra la conservación anatómica del nervio tras la intervención en casos de otosclerosis.

Material y método: Estudio retrospectivo observacional, en que se utilizó la base de datos de otosclerosis del servicio y un cuestionario validado de síntomas relacionados con la cuerda del tímpano. Se dividió la muestra en 2 grupos: sección y conservación (pacientes cuya cuerda del tímpano, manipulada o no, conservó su integridad anatómica). Se compararon la presencia de síntomas, su duración, la técnica quirúrgica empleada y los resultados audiométricos.

Resultados: En total, 78 pacientes (88 oídos): sección (18 oídos; 20%) y conservación (70 oídos; 80%). En general hay síntomas gustativos en el 35% (el 39% en sección; el 34% en conservación). No hay diferencias estadísticamente significativas en la aparición y la duración de los síntomas, así como en la técnica quirúrgica y los resultados audiométricos. Únicamente un paciente de cada grupo presenta sintomatología a largo plazo. Nuestros resultados indican que no hay grandes diferencias clínicas tras la sección al comparar con la conservación de la cuerda del tímpano. Hay una gran variedad de factores que influyen en la aparición de síntomas, como la edad, la cultura gastronómica, la inervación cruzada o el estado previo del oído medio.

Conclusiones: La sintomatología tras la lesión iatrogénica de la cuerda del tímpano tiene, en general, escasa relevancia clínica, sobre todo a largo plazo, tanto si se secciona el nervio como si se manipula en grado variable.

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Introduction

The chorda tympani (CT) is a branch of the facial nerve, a mixed peripheral nerve. It is composed of special afferent myelinated fibres which innervate the fungiform papillae of the anterior 2/3 of the tongue and parasympathetic preganglionic efferent fibres which innervate the submaxillary and sublingual salivary glands. It has a unique feature in the body, namely that part of its route runs through an air cavity, the middle ear, without any kind of bone protection. At this point it is more vulnerable to external damage, either by inflammation in chronic otitis media (COM) or iatrogenic causes, such as heat, drying, stretching, or section.¹ Lesion in the CT during surgery for otosclerosis is common. Bull² found, in 1965, that 80% of patients in whom the CT was sectioned in stapedectomy had concomitant symptoms. These include hypogeusia (reduction of the sense of taste), dysgeusia (abnormal sensation, typically metallic), ipsilateral numbness of the tongue, and xerostomia due to saliva deficit. For a long time, there has been no particular interest in the pathophysiology of the CT. On the one hand, patients and surgeons have historically considered the audiological results as the only important outcomes in surgery for otosclerosis². On the other hand, the exploration of taste sensitivity in isolation of the CT territory is not an easy task.^{3,4} Our study aims to evaluate the role of CT following surgery for otosclerosis, in which the histology and function of the nerve have not previously been damaged, contrary to what happens in cases of COM.^{5,6}

The growing importance of studies of quality of life after surgical procedures justifies this work. We assess the long-term symptoms, comparing the outcomes of patients who had the CT sectioned with those in whom anatomic integrity was maintained.

Material and methods

This is a retrospective observational clinical study. The database of our centre has been used as well as a telephone survey with a validated questionnaire^{3,7} of symptoms related to the role of CT (Table 1). It included patients over 18 years of age operated on between 2000 and 2006 for otosclerosis, demonstrated by fixation of the plate of the stapes to the otic capsule during surgery. We excluded from this study all patients with a condition other than otosclerosis as well as revision surgeries. All operations were performed by 3 experienced surgeons from the department. The main variable in the study was the section or preservation of the nerve during CT surgery. The sample is divided, according to this variable, in a section group (cut nerve) and conservation group (nerves which, manipulated or not, retained their anatomical integrity). We compared the results with regard to: presence or absence of gustatory symptoms, duration of symptoms, surgical technique used (classical stapedectomy, stapedotomy, and laser stapedotomy), and post-operative audiometric results. The statistical analysis of the data was performed with the SPSS 16.0 software for Windows XP.

Table 1 Questionnaire for symptoms related to the chorda tympani

Following surgery, your sense of taste:

Has increased
Has decreased
Is absent
Is the same

Mark with an "X" the option that describes your ability to detect the following flavours:

	It has increased	It has decreased	It is the same
Sweet (sugar, cookie)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sour (lemon, vinegar)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bitter (coffee, tonic)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Savoury	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Do you feel strange tastes, such as a metallic taste

in some foods?
No ☐ Yes ☐ How long for?

Do you feel numbness in your tongue?
No ☐ Yes ☐ How long for?

Do you notice a taste even when there is no food in your mouth?
No ☐ Yes ☐ How long for?

Do you think your symptoms are related to the surgery?

Results

Of the 134 patients who make up the database, 78 answered the questionnaire in full and form our sample; 10 patients presented bilateral otosclerosis, so in total we studied 88 ears operated on between 2000 and 2006. The average (standard deviation) for age was 44 (10.3) (median, 44; range, 21-70) years. Forty-four percent of the operations were laser stapedotomy; 25% classical stapedectomy; and 30% stapedotomy. In 18/88 (20%) cases, the CT was

sectioned (section group). In 70/88 (80%) cases, the CT was not sectioned (conservation group). In our sample, gustatory symptoms were observed postoperatively in 35.2% in 38.9% of patients in the section group and 34.3% of the conservation group. There are no significant differences between groups (section vs conservation) in terms of gustatory symptoms or their duration. The disappearance of symptoms is evidenced in almost all patients one year after surgery. Only one patient in each group presented symptoms with a duration of more than one year. Table 2 shows the specific symptoms the patients referred.

The most relevant is the feeling of metallic taste, which appears in 100% of symptomatic patients in the section group and in 54.2% in the conservation group ($P=.063$). The audiometric results are nearly identical in both groups, regardless of the technique used; the differences are not significant.

Discussion

Stapes surgery aims to improve the hearing of a patient through a surgical operation. In this context, minimizing any possible adverse effects is important. Lesion of the CT is one of the best known and most frequent. In the series of Moon et al⁸ up to 28% of patients operated on developed clinical dysgeusia, which persisted in 17% after 6 months of follow-up.

The CT can be found in the middle of the surgical field, impeding stereoscopic vision with a microscope or making the resection of bone in the posterior wall of the external auditory canal more difficult. In these cases, the surgeon has to decide whether to cut the CT or displace it, manipulating it to varying degrees. There is some controversy about which procedure offers better functional results. Table 3 shows the results in our series and in others in the published literature where there are large discrepancies and statistical significance is not reached, in order to facilitate a universal recommendation. It has traditionally been suggested that an excessive manipulation of the CT, without sectioning it, can have greater repercussions than its section. Since there is no objective measure of the degree of manipulation of the CT in our study, the conservation group includes patients with a highly variable degree of handling, from zero to maximum.

Table 2 Specific symptoms explored by the questionnaire

Symptom explored	Patients with symptoms, section group 7/ 18 (38.9%)	Patients with symptoms, conservation group 24/ 70 (34.3%)	Total patients with symptoms 31/ 88 (35.2%)
General hypogeusia	5/ 7 (71.4%)	16/ 24 (66.7%)	21/ 31 (67.8%)
Hypogeusia only for savoury flavour	1/ 7 (14.2%)	0/ 24	1/ 31 (3.2%)
Bitter taste of all food	1/ 7 (14.2%)	1/ 24 (4.2%)	2/ 31 (6.4%)
Sweet taste of all food	0/ 7	1/ 24 (4.2%)	1/ 31 (3.2%)
Metallic taste in food	7/ 7 (100%)	13/ 24 (54.2%)	20/ 31 (64.5%)
Numb tongue	3/ 7 (42.9%)	6/ 24 (25%)	9/ 31 (29%)
Ghost flavour	2/ 7 (28.6%)	5/ 24 (20.9%)	7/ 31 (22.6%)
Xerostomia	2/ 7 (28.6%)	4/ 24 (16.7%)	6/ 31 (19.3%)

Table 3 Incidence of flavour alterations in otologic surgery

Author	Patients with symptoms (CT section)	Patients with symptoms (CT conservation)	Total patients with symptoms	Comments
Yeo et al ⁹	11/ 14 (79%)	10/ 17 (59%)	21/ 31 (67.7%)	Only stapedectomies
Gopalan et al ¹¹	4/ 32 (13%)	9/ 61 (14.7%)	13/ 93 (14%)	All kinds of operations
Rice ²⁰	30/ 52 (58%)	31/ 64 (49%)	61/ 116 (52.6%)	Only stapedectomies
Yung et al ²¹	5/ 22 (22.7%)	15/ 137 (10.9%)	20/ 159 (12.6%)	Only stapedectomies
Saito et al ¹⁹	44/ 113 (38.9%)	38/ 149 (25.5%)	82/ 262 (31.3%)	All kinds of interventions
Mahendran et al ¹²	21/ 22 (95%)	17/ 33 (52%)	38/ 55 (70%)	Only stapedectomies
Galindo et al	7/ 18 (38.9%)	24/ 70 (34.3%)	31/ 88 (35.2%)	Only stapedectomies

CT indicates chorda tympani.

Previous studies have compared the symptoms related with CT in various otologic conditions.^{1,10-12} In COM, the chronic inflammation produces preoperative histologic damage. There is a thickening of the perineurium and epineurium, vacuolar degeneration of the Schwann cells,⁶ disappearance of amyelinic fibres, oedema, and deposition of collagen between nerve sheaths.⁵ After surgery for COM, the patients presented symptoms less frequently than in cases of otosclerosis, in which the role of CT had not been altered. In the series of Gopalan et al¹¹ there were dysgeusia symptoms in 6.5% of patients operated on for myringoplasty, 15% in cases of mastoidectomy, and 57% in tympanostomies.

There are several alternatives to assess the role of CT. Electrogustometry (EGM) is a quantitative test based on the application of galvanic stimulation to the tongue, which evokes a metallic taste in the subject. Despite being a reliable and validated method,^{13,14} the results of EGM can be discordant with the clinical presentation, as there are altered thresholds in asymptomatic patients.¹⁹ Therefore, in this study we preferred to use a validated questionnaire of symptoms.^{3,7} However, the assessment of the sense of taste is difficult. Various nerves conduct the stimuli of the different territories: the CT from the anterior 2/3 of the tongue, the greater superficial petrosal nerve from the palate, the IX pair from the posterior 1/3 of the tongue and the X pair from the epiglottis and the base of the tongue. Denervation of an isolated area may cause little or no symptoms. Moreover, in accordance with previous studies,⁴ 80% of the taste of a dish is due to its odour. The loss of smell is often interpreted as a loss of taste. It is therefore important that the patient is appropriately instructed to make the questionnaire reliable.

In our study, symptoms appear in 39% of patients in the section group and in 34% of the conservation group. As for the clinical presentation, most of our symptomatic patients referred widespread hypogeusia, and it is rare for patients to notice only 1 taste (2 patients, bitter and 1, sweet). The sensation of metallic taste appears in 100% in the section group and in 54.2% in the conservation group ($P=0.63$). Other symptoms, such as dry mouth, ghost taste, and numbness of the tongue, often appear together in the more symptomatic patients. These symptoms tend to disappear at the same time.

It is noteworthy that only 1 patient in each group presented symptoms of more than a year of evolution

(5.5% in the section group and 1.5% in the conservation group). The results of our study, consistent with other published results, show that in the long term, there are no significant differences between patients in whom the CT was preserved compared with those in whom the CT was sacrificed during surgery. In the series of Saito et al¹⁹ the group of patients with CT section had 5.3% of long term dysgeusia, whereas it appeared in only 2.7% when the CT was preserved.

There are several theories to explain the functional recovery. According to Saito et al,^{15,16} the nerve can regenerate. The functional outcome is better if there is a reconstruction of the sectioned nerve, approximating or even stitching the ends on the tympanum. Tomita et al¹⁷ concluded that denervated area is very small, since there is a large area of cross-innervation and an important contribution of the IX pair, which compensate for the unilateral loss of the CT. Furthermore, the inhibition exerted by the CT on the IX pair disappears when the CT is damaged, which could be another compensation mechanism. Grant et al¹⁸ propose an alternative to the CT through the V cranial pair.

Conclusions

Surgery for otosclerosis is designed to improve the quality of life of a patient, including hearing. Iatrogenic injury of the CT is, occasionally, an undesired and disturbing effect, and, therefore, further study of this complication may impact significantly on the overall results of surgery. Our study shows that, in general, the lesion of the CT is a complication of low long-term clinical relevance, whether the nerve was sectioned or manipulated during surgery.

Conflict of interests

The authors have indicated there is no conflict of interest.

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