

Glomus tympanicum – clinical characteristics and surgical management

Przyzwojaki jamy bębenkowej – charakterystyka kliniczna i postępowanie chirurgiczne

Izabela Łukawska-Popieluch, Robert Bartoszewicz, Krzysztof Morawski, Kazimierz Niemczyk

Katedra i Klinika Otolaryngologii, Warszawski Uniwersytet Medyczny, Warszawa, Polska

Article history: Received: 08.01.2018 Accepted: 25.02.2018 Published: 30.03.2018

ABSTRACT:

Objective: The aim was to determine the clinical characteristics and analysis of surgical treatment of patients with glomus tympanicum hospitalized in the Department of Otorhinolaryngology.

Material and methods: Between 2000 and 2015, 27 patients were hospitalized. Age ranged 28-79 years old. The study analyzed data from the clinical examination and the type of surgical technique.

Results: The most common symptoms were tinnitus and hearing loss. Resection of the tumor was performed by anterior tympanotomy in 3 (11,1 %), CWU mastoidectomy in 21 (77,8 %), CWD mastoidectomy in 1 (3,7 %), lateral petrosectomy in 2 (7,4 %) patients.

Conclusion: Glomus tympanicum have a quite characteristic clinical picture with dominant symptoms of tinnitus, hearing loss and reddening of the tympanic membrane in otoscopic examination. This type of tumors require surgical treatment. Surgical access depends on the size of the tumor in the tympanic cavity. Most of these tumors can be removed using antromastoidectomy, with posterior tympanotomy and hypotympanotomy.

KEYWORDS:

glomus tympanicum, middle ear, diagnosis

STRESZCZENIE:

Cel: Charakterystyka kliniczna oraz analiza postępowania chirurgicznego pacjentów z przyzwojakami zlokalizowanymi w jamie bębenkowej leczonych w Klinice.

Materiał i metody: W latach 2000 - 2015 w Klinice leczonych było 27 pacjentów z przyzwojakami jamy bębenkowej. Wiek pacjentów wahał się między 28 a 79 lat. Analizowano dane z badania podmiotowego, przedmiotowego pacjenta oraz postępowanie chirurgiczne.

Wyniki: Najczęstszymi zgłaszanymi przez pacjentów dolegliwościami były jednostronne szумы uszne oraz niedosłuch. Wśród technik chirurgicznych zastosowano tympanotomię przednią u 3 (11,1 %), antromastoidektomię z tympanotomią tylną w 21 (77,8 %), antromastoidektomię ze zniesieniem ściany przewodu słuchowego zewnętrznego w 1 (3,7 %), petrosektomię boczną w 2 (7,4 %) przypadkach.

Wnioski: Przyzwojaki jamy bębenkowej mają dość charakterystyczny obraz kliniczny z dominującymi objawami szumów usznych, niedosłuchem oraz zaczerwienieniem błony bębenkowej w badaniu otoskopowym. Guzy tego typu wymagają leczenia operacyjnego, dostęp operacyjny zależy od wielkości guza w jamie bębenkowej. Większość opisywanych guzów można usunąć stosując dostęp zauszny z antromastoidektomią i tympanotomią oraz hypotympanotomią tylną.

SŁOWA KLUCZOWE: przyzwojak jamy bębenkowej, ucho środkowe, diagnoza

INTRODUCTION

Glomus tympanicum are histologically benign tumors of neurogenic origin. They develop from paraganglion of the parasympathetic nervous system. A typical feature of these tumors is their slow growth and rich vascularity. Tumors occurring in the tympanic cavity are referred to as *glomus tympanicum* [1]. The most frequently reported complaints are tinnitus and hearing loss. In the otoscopic examination, redness, relief, and in some cases also pulsating of the tympanic membrane are observed [2,3,4]. A detailed ENT examination of the patient together with the assessment of imaging examinations play an important role in the diagnostic process of this type of cancer. Magnetic resonance imaging (MRI) or computed tomography (CT) are complementary methods in assessing the tumor stage before surgery. CT reveals the mass of the tumor lying on the *promontorium*, strengthened after implementation of the contrast. It also allows assessment of the bony structures of the middle ear, the inner ear and the jugular foramen. MRI, on the other hand, perfectly describes relation of the tumor to the surrounding soft structures, vessels and invasion both intra- and extracranial [5,6,7]. The main goal of paraganglioma treatment is complete tumor resection. Depending on the tumor stage various surgical techniques are used, such as tympanotomy or mastoidectomy [7, 8].

AIM OF THE STUDY

The aim of this study is clinical characteristics and analysis of surgical management of patients with paragangliomas located in the tympanic cavity, in patients treated in the Clinic.

MATERIAL AND METHODS

A retrospective analysis of the medical records of patients diagnosed with a paragangliomas of the tympanic cavity and temporal bone was made. In the years 2000 - 2015, there were 27 patients with paragangliomas developing in the tympanic cavity (26 women and 1 man) treated in the Clinic. All patients received a diagnosis based on the result of histopathological examination. Patients' age varied between 28 and 79 years. The average age was 53.6 years (SD = 14.9). The work analyzed the data from patient's physical examination such as: occurrence of hearing loss, tinnitus, otorrhea, aural fullness, earache, asymmetry of the face, vertigo, balance disorders. The data from the physical examination were also analyzed with the accurate assessment of the tympanic membrane (reddened or blue-purple, bulge, pulsating) and external auditory canal (EAC) in the otoscopic exam-

Tab I. Glasscock & Jackson classification [9].

TUMOR STAGE	EXTENT OF CHANGE
Paragangliomas developing from the tympanic cavity (glomus tympanicum)	
I	Tumor mass limited to the promontory
II	Tumor mass filling the space of the middle ear
III	Tumor filling the middle ear and spreads towards the mastoid process
IV	Tumor filling the middle ear, mastoid process or filling the external auditory canal; it can grow forward from the internal carotid artery

Tab. II. Characteristic of the study group.

CHARACTERISTICS OF THE ANALYZED GROUP	NUMBER OF PATIENTS	%
Female	26	96,3
Male	1	3,7
Side of the tumor		
Tumor located on the left side	15	55,6
Tumor located on the right side	12	44,4
Tumor with multiple location	1	3,7
Tumor stage		
I	7	25,9
II	18	66,7
III	0	0
IV	2	7,4

Tab. III. The results of subjective and objective examination of the patient.

RESULTS OF CLINICAL EXAMINATION	NUMBER OF PATIENTS	%
pulsatile tinnitus	25	96,2
hearing loss	24	88,9
aural fullness	8	29,5
otalgia	6	22,2
balance disorders	3	11,1
dizziness	2	7,4
otorrhea	5	18,5
tympanic membrane		
reddened	24	88,9
bulged	17	65,4
pulsating	4	15,4
polyp in the external auditory canal	2	7,4

ination. The tumor stage was determined using the Glasscock and Jackson classification (Table I) [9]. The extent of this group of tumors was assessed on the basis of data from a clinical data, imaging examinations and surgical descriptions. All patients underwent surgical treatment (anterior tympanotomy, antromastoidectomy with posterior tympanotomy, lateral petrosectomy). Before the procedure, each patient underwent CT and / or MRI to exclude the presence of a tumor in the jugular foramen.

RESULTS AND ANALYSIS

In the years 2000 - 2016, 27 patients with tympanic paragangliomas were treated in the Clinic. The majority of patients in the study group were women. In the presented material, 15 tumors were found on the left side (55.6%) and 12 tumors on the right side (44.4%). In one case, multiple lesions were observed: on the left side the tumor was located in the tympanic cavity and on the right side within the jugular bulb. All patients before surgery had normal facial nerve function. Data are presented in Table II.

Subjective complaints reported by the patients were unilateral tinnitus (96.2%) and hearing loss (88.9%). The less common symptoms were: aural fullness, earache, balance disorders, dizziness, otorrhea. In the otoscopic examination, the red or blue-purple mass behind tympanic membrane was recorded. In 2 cases (7.4%), a polyp was found in the EAC. Table III presents the results of subjective and objective examination of the analyzed group.

The time from first symptoms to diagnosis was on average 28.4 (standard deviation 22.7, median 23.5) month.

In all patients, appropriate surgical treatment was applied depending on the extent of the tumor. In the first tumor stage, 7 patients (25.93%) were included. Three patients underwent tumor resection via anterior tympanotomy. The anterior tympanotomy performed by Rosen's incision in the EAC was applied in 2 patients, and in 1 cases, by a cut behind the ear. A further 4 patients underwent posterior antromastoidectomy with posterior tympanotomy. The most, 18 (66.7%) tumors were operated in stage II according to Glasscock and Jackson classification. In this group of patients, the main surgical access was the making a wide antromastoidectomy with posterior tympanotomy. In 12 patients (44.4%), depending on the intraoperative conditions, posterior tympanotomy was extended to the hypotympanotomy. Intraoperative visualization and assessment of the ossicles makes it possible to simultaneously reconstruct the ossicular chain in the middle ear. In 1 case (3.7%), double access was used: antromastoidectomy with posterior tympanotomy and anterior tympanotomy. Also in 1 case (3.7%) in this group of tumors, canal wall down mastoidectomy was. In this cases mentioned above, the patient was operated due to paraganglioma in another center several years earlier. Two patients (7.4%) who underwent lateral petrosectomy were in the group of patients with IV stage of tumor.

The tumor was removed completely in all patients operated on in the Clinic.

Tab. IV. The type of surgical technique, the direction of tumor growth, complications.

TYPE OF SURGICAL TECHNIQUE	NUMBER OF PATIENTS	%
anterior tympanotomy	3	11,1
antromastoidectomy with posterior tympanotomy	20	74,1
antromastoidectomy with posterior tympanotomy and hypotympanotomy	12	44,4
double access: antromastoidectomy with posterior tympanotomy and anterior tympanotomy	1	3,7
canal wall down mastoidectomy	1	3,7
lateral petrosectomy	2	7,4
Direction of tumor growth (patients after petrosectomy were not considered)		
epitympanum	5	18,5
hypotympanum	14	51,9
facial nerve recess	3	11,1
tympanic sinus	1	3,7
around the internal carotid artery	1	3,7
opening of auditory tube	4	14,8
Postoperative complications		
facial nerve paresis (III-V / VI → I-II / VI according to the H-B scale)	5	18,5

Among postoperative complications, facial nerve paresis (III-V / VI degree according to the House Brackmann scale) was recorded. The facial nerve paresis after tumor resection occurred in 5 patients (18.5%). These complications disappeared till one year after surgery.

Table IV shows the type of surgical technique, the direction of tumor growth, complications.

DISCUSSION

The first reports of the temporal bone paraganglioma comes from Stacy R. Guild [10], who in 1941 described an oval lesion located in the bulb of the jugular vein and promontory of the middle ear, located along the course of Jacobson's nerve - a branch of the glossopharyngeal nerve. He named it „glomus jugularis” [10]. Four years later, Harry Rosenwasser described the case of a 36-year-old man with a middle ear tumor penetrating into the EAC. During tumor resection, he noticed strong adhesion in the hypotympanum area and intense bleeding. The result of histopathological examination confirmed the presence of „carotid body tumor” [11].

Due to the great interest of researchers in the discussed tumors, since the first reports on this issue, numerous descriptions and reports on the own experiences of authors on the clinical symptoms, diagnosis and treatment of paraganglioma appeared in the literature. In 1962, Bob R. Al-



Fig. 1. Glomus tympanicum tumor.
A - view obtained during videotoscopy,
B - CT scan, axial view. Right ear.

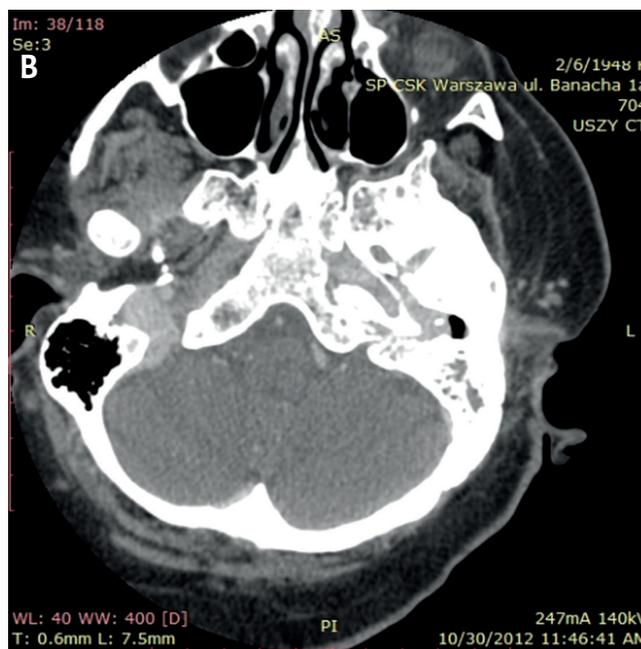


Fig. 2. Glomus tympanicum tumor. View obtained during microscopic examination

ford and Fred R. Guildford proposed changes in the nomenclature and distinguished tumors growing and restricted to the tympanic cavity by reserving for them the term *glomus tympanicum* [12].

Paragangliomas are slow-growing, richly vascularized, usually non-malignant tumors. In the collected material, as in the available literature [2, 12, 13, 14], the disease is more commonly reported in women. In the results obtained from 27 operated patients, only one was male. Rohit et al. presented a group of 17 patients with a histopathologically confirmed result of tympanic paraganglioma. In all cases there were only women [13]. Subsequently, Papispyrou et al. presented the results of treatment in a group of 17 patients with paraganglioma of the tympanic cavity and temporal bone, in which women predominated (women - 12, men - 5) [14].

The paragangliomas of the tympanic cavity and temporal bone most often exhibit pulsating, unilateral tinnitus with varying degrees of severity and initially conductive hearing loss, and as the disease progresses, also sensorineural. According to data in the literature, the prevalence of tinnitus in patients with paragangliomas of the tympanic cavity and temporal bone oscillates between 75 and 82% of cases. Similar results concern hearing loss, which are estimated between 50 and 73.5% of cases [15, 16, 17]. The results recorded in the presented study amount to 96.2% and 88.9% respectively.

The time from the first symptoms to making a diagnosis in the analyzed material was on average 28.4 months. It is understandable that a patient who previously had no hearing problems will surely notice when his hearing suddenly worsens, e.g. after mechanical or acoustic trauma. However, it is harder to noticed by patient slowly progressing hearing loss. Usually, the patient reports to the doctor just when the hearing loss becomes troublesome and hinders daily functioning. Similarly is with tinnitus, which the degree of severity can

vary significantly. Often patients at the beginning ignore this problem and they come to the doctor when this discomfort becomes troublesome. Because of the causes of tinnitus can be very diverse, that is why the entire diagnostic process is often prolonged. However, it should be emphasized, that the pulsating tinnitus should always arouse the laryngologist's vigilance for the presence of a paraganglioma. Therefore, the majority of patients are diagnosed in the stage of tumor progression, which is so large that it gives persistent symptoms and prompts the patient to further diagnosis. Similar data regarding the time from the appearance of symptoms to the diagnosis 2 - 3 years are given in the literature [18, 19, 20].

The accurate assessment of the eardrum is of crucial importance in making the initial diagnosis. In the otoscopic examination, reddening and bulge of the tympanic membrane is recorded. In some cases, pulsating of the eardrum may also be observed. Among other complaints reported by patients are: aural fullness, otalgia, otorrhea, dizziness [2, 5, 15, 21, 22]. The current study also noted the above-mentioned symptoms (aural fullness (29.6%), otalgia (22.2%), otorrhea (18.5%), dizziness (7.4%).

Depending on the extent of the tumor, various surgical approaches are described in the literature. In case of the very small tumors (stage I according to the Glasscock and Jackson scale), the access to the tumor is achieved through anterior tympanotomy using semi-circular cut in the EAC or incision behind the ear. After detachment of the meatotympanic flap from the bones of the EAC, the bone frame border of the EAC is broadened using a diamond drill. This allows better control and view into the operational field. Due to the rich vascularization of the tumor, bipolar coagulation is helpful. The tumor mass is reduced, the nourishing vessels are closed and therefore tumor can be removed easier [14, 15, 16, 23]. Glasscock et al. emphasize that the above-mentioned surgical approaches can be used in the case of tumors limited to the promontory with apparently outlined borders in the otoscopic examination with intact eardrum [24]. Gjuric et al. indicate the use of a anterior tympanotomy with incision in the EAC or behind the ear and complete resection in 7 out of 11 paragangliomas growing in the tympanic cavity [25]. In the presented group this technique was used in 3 cases. The remaining 4 patients with stage I tumors were operated by performing antromastoidectomy with posterior tympanotomy, because according to the authors of the study, a wide view into the surgical area and optimal tumor visualization facilitate radical resection.

Performing a wide antromastoidectomy with posterior tympanotomy enables the best exposure and control of the tumor. This type of surgical approach helps in the assessment of the paraganglioma's spreading towards the attic, the oval window

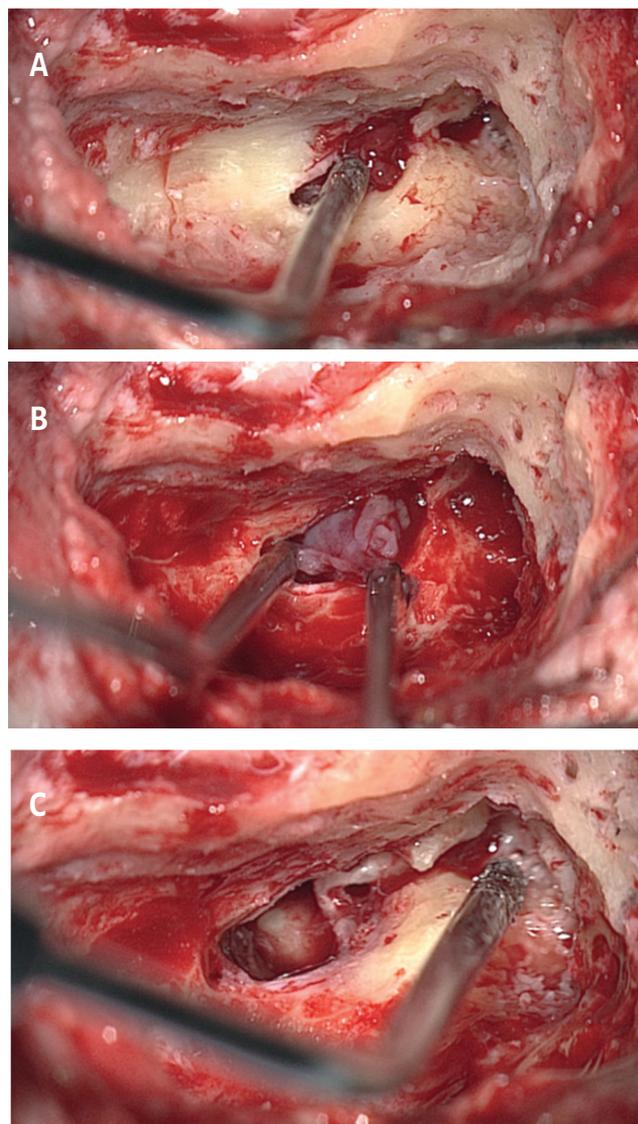


Fig. 3. Glomus tympanicum tumor.
A - view obtained during videootoscopy,
B - MRI with contrast, axial view. Left ear.

area, the round window, the ear tube, the facial nerve recess and the tympanic sinus [13, 14, 16, 17, 24, 25, 26]. When tumor occupies the hypotympanum, additional posterior hypotympanotomy facilitates resection of the tumor in this area [15, 25]. In the analyzed group, among 20 patients in whom the tumor was removed by performing antromastoidectomy with posterior tympanotomy, 12 had hypotympanotomy performed. They were patients in the second stage according to Glasscock and Jackson classification. Using the above-mentioned surgical technique, particular care should be taken not to damage the ossicular chain as well as the facial nerve. When tumor is closely attached to the ossicular chain with or without their

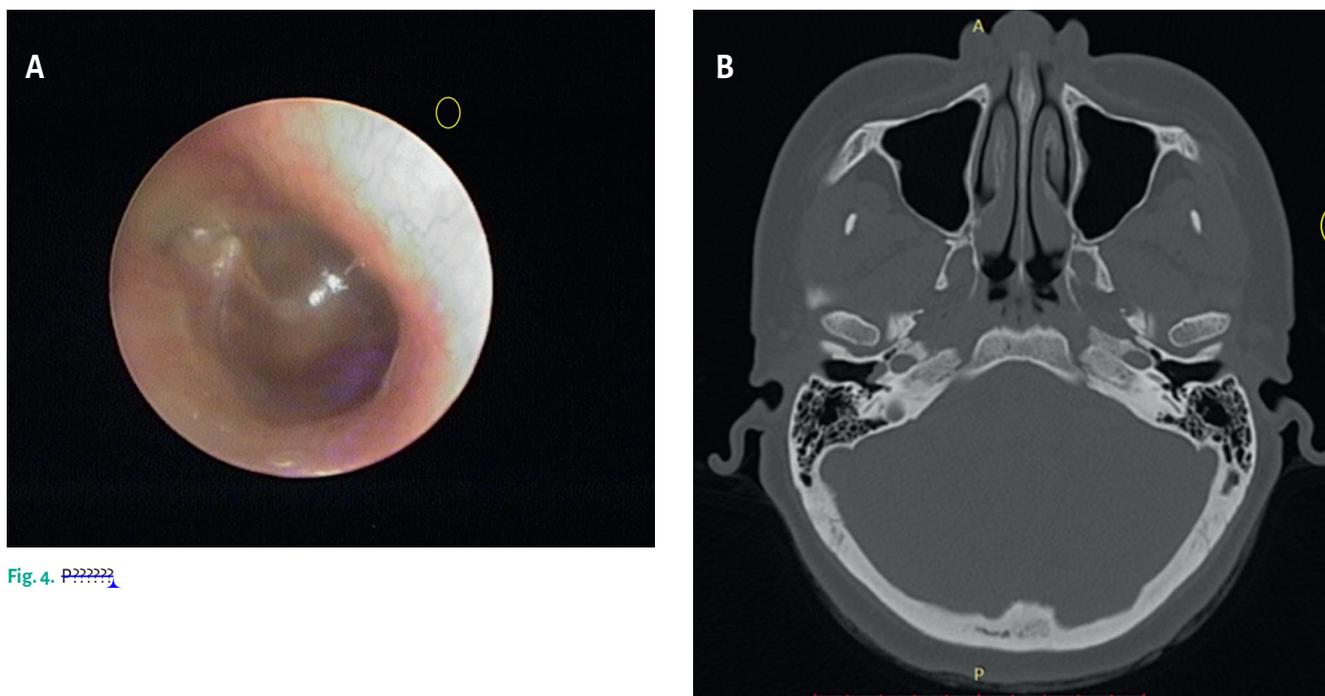


Fig. 4. P???????

destruction, it is necessary to separate the elements of the ossicular chain with simultaneous or deferred reconstruction [4, 24, 25, 26]. In connection with the above, tumor approach by performing antromastoidectomy with posterior tympanotomy gives the possibility of radical tumor resection, facial nerve control and reconstruction of the ossicular chain.

Large tumors that fill the middle ear, mastoid process and / or EAC or expand forward from the internal carotid artery are removed by performing a lateral petrosectomy with total closure of the post-surgical cavity and filling it with fatty tissue taken from the abdominal wall and suturing the external acoustic duct [15, 26, 27, 28].

References

1. Chou YL, Huang BR, Wang ChH. En bloc surgical removal of an asymptomatic glomus tympanicum tumor. Case report. J Chin Med Assoc 2011; 74: 520-522.
2. Skrivan J, Zverina E, Kluch J, Chovanec M, Padr R. Our experience with surgical treatment of tympanojugular paragangliomas. Prague Medical Report 2010; 1: 25 – 34.
3. Van den Berg R. Imaging and management of head and neck paragangliomas. Eur Radiol 2005; 15: 1310 – 1318.
4. Subashini P, Mohanty S. Altered clinical course of glomus tympanicum - a case report. Indian J Otolaryngol Head Neck Surg 2008; 60:35–36.
5. Boedeker CC, Ridder GJ, Schipper J. Paragangliomas of head and neck: diagnosis and treatment. Fam Cancer 2005; 4: 55 – 59.
6. Rigby PL, Jackler RK. Clinicopathologic presentation and diagnostic imaging of jugular foramen tumors. Operative techniques in Otolaryngol - Head and Neck Surgery 1996; 7 (2): 99 – 105.
7. Singh VK, Badhwar S, D'Souza J, Indrajit IK. Glomus Tympanicum MJAFI, 2004; 60 (2): 200-203.

CONCLUSIONS

Glomus tympanicum have a quite characteristic clinical picture with dominant symptoms of tinnitus, hearing loss and reddening of the tympanic membrane in the otoscopic examination.

This type of tumors require surgical treatment, surgical access depends on the size of the tumor in the tympanic cavity.

Most of these tumors can be removed using antromastoidectomy, with posterior tympanotomy and hypotympanotomy



8. Hutchins T, Palacios E. Glomus tympanicum tumor. *ENT-Ear Nose Throat* 2007; 86 (4): 202,204.
9. Jackson CG, Glasscock ME, Harris PF. Glomus tumors. Diagnosis, classification, and management of large lesions. *Arch Otolaryngol* 1982; 108 (7): 401-410.
10. Guild SR. A hitherto unrecognized structure, the glomus jugularis, in man. *Anat Rec* 1941; 79 (suppl): 28.
11. Rosenwasser H. Carotid body tumor of the middle ear and mastoid. *Arch Otolaryngol* 1945;41:64-67.
12. Alford BR, Guilford FR. A comprehensive study of tumors of the glomus jugulare. *Laryngoscope* 1962;72:765-805.
13. Rohit, Jain Y, Caruso A, Russo A, Sanna M. Glomus tympanicum tumor: an alternative surgical technique. *J Laryngol Otol* 2003; 117 (6): 462 - 466.
14. Papaspyrou K, Mewes T, Toth M, Schmidtman I, Amedde RG, Mann WJ. Hearing results after hypotympanotomy for Glomus Tympanicum Tumors. *Otol Neurotol* 2011; 32 (2): 291 - 296.
15. Sanna M, Fois P, Pasanisi E, Russo A, Bacciu A. Middle ear and mastoid glomus tumors (glomus tympanicum): An algorithm for the surgical management. *Auris Nasus Larynx* 2010; 37: 661 - 668.
16. Mahadevaiah A, Parikh B, Kumaraswamy K. Surgical management of glomus tympanicum tumor. *Indian J Otolaryngol Head Neck Surg* 2007; 59 (1): 5 - 8.
17. Alaani A, Chavda SV, Irving RM. The crucial role of imaging in determining the approach to glomus tympanicum tumours. *Eur Arch Otorhinolaryngol* 2009; 266: 827 – 831.
18. Moe KS, Li D, Linder TE, Schmid S, Fisch U. An update on the surgical treatment of temporal bone paraganglioma. *Skull base surgery* 1999; 9 (3): 185 - 194.
19. Spector GJ, Ciralsky RH, Ogura JH. Glomus tumors in the head and neck III: Analysis of clinical manifestations. *Ann Otol Rhinol Laryngol* 1975; 84: 73 - 79.
20. van der Mey AG, Frijns JH, Cornelisse CJ, et al. Does intervention improve the natural course of glomus tumors? A series of 108 patients seen in a 32-years period. *Ann Otol Rhinol Laryngol* 1992; 101: 635 - 642.
21. Forest III JA, Jackson G, Benjamin MM. Long term control of surgically treated glomus tympanicum tumors. *Otol Neurotol* 2001; 22: 232 – 236.
22. Jackson CG. Glomus tympanicum and glomus jugulare tumors. *Otolaryngol Clin North Am* 2001; 34: 941 – 970.
23. Rosen S. Glomus jugulare tumor of middle ear with normal drum; improved biopsy technique. *Ann Otol Rhinol Laryngol* 1952; 61 (2): 448 - 451.
24. Glasscock ME, Jackson CG, Dickins JR, Wiet RJ. Panel discussion: glomus jugulare tumors of the temporal bone. The surgical management of glomus tumors. *Laryngoscope* 1979; 89: 1640 - 1654.
25. Gjuric M, Seidinger L, Wigand ME. Long-Term results of surgery for temporal bone paraganglioma. *Skull Base Surgery* 1996; 6 (3): 147 - 152.
26. Oldring D, Fisch U. Glomus tumors of the temporal region: surgical therapy. *Am J Otolaryng* 1979; 1 (1): 7 - 18.
27. Carlson ML, Sweeney AD, Pelosi S, et al. Surgical management of glomus tympanicum: a review of 115 cases over four decades. *Otolaryngol Head Neck Surg* 2015;152:136–42.
28. Jenkins HA, Fisch U. Glomus tumors of the temporal region. *Arch Otolaryngol*. 1981; 107: 209 - 214.

Word count: 2200 Tables: 4 Figures: 9 References: 28

Access the article online: DOI: 10.5604/01.3001.0011.6792 Table of content: <https://otorhinolaryngologypl.com/issue/10687>

Corresponding author: Izabela Łukawska-Popieluch; Department of Otolaryngology Medical University of Warsaw, Poland; e-mail: izabelalukawska@wp.pl

Copyright © 2018 Polish Society of Otorhinolaryngologists Head and Neck Surgeons. Published by Index Copernicus Sp. z o.o. All rights reserved

Competing interests: The authors declare that they have no competing interests.

Cite this article as: Łukawska-Popieluch I., Bartoszewicz R., Morawski K., Niemczyk K.: Glomus tympanicum —clinical characteristics and surgical management; *Pol Otorhino Rev* 2018; 7(1):8-15
