

# Glomus tympanicum tumour: an alternative surgical technique

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## Abstract

Glomus tympanicum tumour is one of the commonest neoplasms of the middle ear. It is more common in females. The most common presenting symptom is pulsatile tinnitus. A retrotympanic mass is found in the middle ear in all the cases. Computed tomography (CT) scan is the investigation of choice, however in difficult cases magnetic resonance imaging (MRI) can be helpful. Surgery is regarded as the gold standard of treatment in spite of the fact that radiation therapy has also been advocated in the literature. In this series 17 cases of glomus tympanicum treated at Gruppo Otologico Piacenza – Rome (Italy) were analysed retrospectively. A simple and safe technique has been described. All the cases were female and treated by surgery. The tumour was removed completely in all the cases and the ossicular chain kept intact. Recurrence was encountered in only one case after nine years. Surgical removal of the tumour is recommended as the treatment of choice with the following advantages: complete removal, a low complication rate, a low recurrence rate, acceptable hearing level and minimum morbidity.

**Key words:** Paraganglia, Nonchromaffin, surgery; Ear, Neoplasms; Tinnitus

## Introduction

Glomus tumours represent the most common primary neoplasm of the middle ear and management of these tumours is not a new subject since diagnosis and treatment is hardly controversial. However, the literature has sporadically suggested radiation as the primary therapy (alone/pre-operatively)<sup>1,2</sup> but total removal through conservative middle-ear surgery is still considered as the gold standard of the treatment.<sup>3</sup> Advances in the field of imaging and technical refinements in traditional surgery have made correct diagnosis and complete excision of these tumours possible in most of the cases.

According to Fisch's classification,<sup>4</sup> glomus tympanicum corresponds to a class A tumour. This class includes very small tumours (limited to the promontory) together with the tumours filling the middle-ear cleft completely. We have further subdivided these tumours on the basis of clinical finding i.e. Class A1 – tumours that can be seen completely on otoscopic examination and Class A2 – tumours that cannot be visualized completely on otoscopic examination. This classification also helps us to formulate a surgical plan. For Class A1 tumours a simple trans-canal tympanotomy can permit the total removal. While for Class A2 tumours, a wider approach is required in order to remove the tumour completely.

The aim of this study is to analyse retrospectively our experience with glomus tympanicum and to outline a simple, effective and expeditious technique<sup>5</sup> for the safe and complete removal of the tumour. This technique has been developed and used by the senior author M.S. at Gruppo Otologico (Piacenza – Rome, Italy). It provides maximal exposure of the tumour through the retro-auricular trans-canal route, and reduces the possible risk of injury to the tympanic membrane (TM) and canal skin. Following this technique complete tumour removal with preservation of the ossicular chain can be achieved.

## Diagnosis

Glomus tympanicum tumours originate from the glomus chemoreceptors that course along the tympanic segment of Jacobson's (IXth) nerve or along Arnold's (Xth) nerve in the middle ear. Glomus bodies are found commonly in the mesotympanum and rarely in the epitympanum.<sup>6</sup> Glomus tympanicum tumours do not involve the jugular bulb although when large, may extend beyond the confines of the middle ear.

Most patients complain of pulsatile tinnitus, hearing loss (conductive, mixed or sensorineural) and otalgia. Brown's sign<sup>7</sup> (blanching of the tympanic membrane on pneumatic otoscopy) can be seen in only one third of patients. A retrotympanic mass

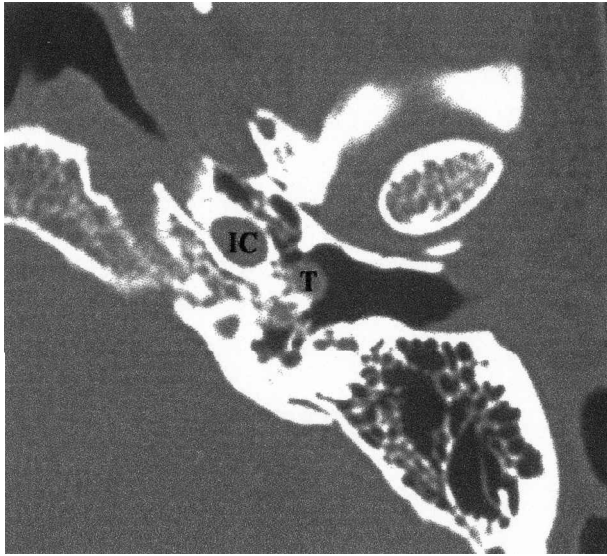


FIG. 1

CT scan showing glomus tympanicum limited to promontory (Class A1). T = tumour, IC = internal carotid artery.

(dark red in colour) is seen in all the patients. The margins are usually obscured so that the differentiation between a glomus tympanicum and jugulare can not be made clinically. Rarely glomus tympanicum may transgress the tympanic membrane and appear as an inflammatory polyp in the (external auditory canal) EAC. Biopsy of a vascular middle-ear mass prior to the definitive surgery is not necessary and is in fact contraindicated because it can lead to troublesome bleeding.

While the differential diagnosis of the middle-ear masses is extensive, the location in the middle ear and its appearance can give a clue to its probable histology. A vascular mass in the anterior quadrant is likely to be an aberrant carotid artery,<sup>8</sup> posterior superior masses typically represent facial nerve neuroma or an inflammatory polyp, a mass in the mesotympanum can be a schwannoma of Jacobson's nerve.<sup>9</sup> A high jugular bulb will also present in the inferior quadrant but can usually be differentiated from a glomus tumour by its dark blue or purple colour.<sup>10</sup>

The surgical approach for removal of these tumours is based upon the clinical appearance of the tumour and its extensions, which are evident on imaging studies.<sup>11</sup> At the Gruppo Otologico, Piacenza – Rome, Italy initial radiological evaluation consists of a high resolution computed tomography (CT) scan with contrast, in the axial and coronal planes (bone and soft tissue window) with 1.5 mm cuts through the temporal bone. For masses consistent with glomus tumours, the extent of the lesion and possible involvement of adjacent structures such as the carotid artery, jugular bulb and facial nerve can be ascertained precisely with the help of high resolution CT scan (HRCT) with contrast. The presence of air or bone between the tumour and the jugular bulb characterizes the mass as a tympanicum tumour. Magnetic resonance imaging (MRI) is still evolving in its application and reliability for glomus tympanicum because of its

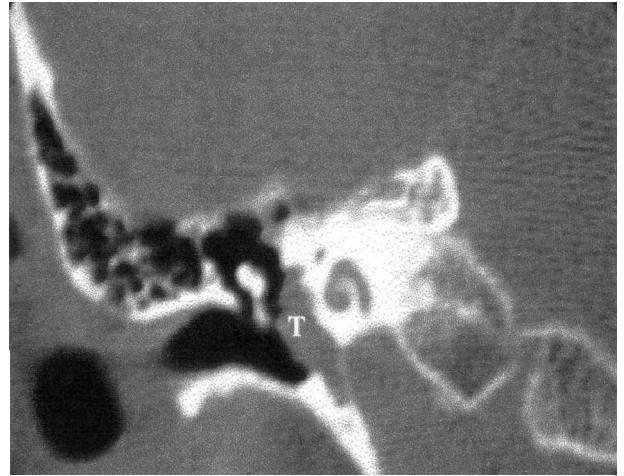


FIG. 2

CT scan showing glomus tympanicum filling the middle ear (Class A2). T = tumour.

inability to define the tumour soft tissue mass relative to the bony anatomy of the temporal bone. In borderline cases MRI with, or without, gadolinium DTPA can give valuable information about the involvement of the jugular bulb and carotid artery.<sup>12</sup>

### Material and methods

The charts of 17 patients with a diagnosis of glomus tympanicum treated at the Gruppo Otologico from February 1992 to June 2002 were reviewed retrospectively. The patients in this study were then categorized according to age, sex, presenting symptoms, and side of the tumour. Findings on initial examination were noted. Pre- and post-operative pure tone averages were calculated using results at 500, 1000, 2000 and 4000 Hz for air and bone conduction. Pre-operative studies included HRCT scan as well as tests for general fitness. The tumour was staged according to Fisch's classification with our own modification i.e. Class A1 and A2 (Figures 1 and 2). The type of surgical approach and operative findings were recorded. Any operative complication immediate or delayed was noted. Follow up was defined as the period of time from surgery to the most recent office visit.

### Surgical technique

Class A1 tumours are managed with a standard stapedectomy-type trans-canal approach.<sup>13</sup> To manage Class A2 glomus tumours, the original retroauricular transcanal approach<sup>14</sup> was modified resulting in better exposure and complete removal of tumour with less morbidity.<sup>5</sup>

A traditional retro-auricular incision is made,<sup>15</sup> and the mastoid cortex and spine of Henle are exposed. The posterior meatal flap is elevated and then an incision is made in the anterior meatal skin to raise a flap from lateral to medial. If there is a lump or bony protrusion in the EAC, it can be drilled away at the same time (keeping an aluminium sheet over the elevated flap for protection). This aluminium sheet can be easily made by cutting the

TABLE I  
PRESENTING SYMPTOMS OF THE PATIENTS

Symptoms	n (%)
Hearing loss	11 (64.7)
Tinnitus	12 (70.6)
Dizziness/vertigo	02 (11.8)
Otalgia	03 (17.6)

covering of the suture material according to the diameter of EAC. Thereafter the fibrous annulus is elevated from the bony sulcus and the TM is separated from the handle of the malleus. During the elevation of the TM from the malleus sharp dissection is carried out by means of a beaver knife in order to cut the periosteum along the long axis of the manubrium. No coagulation is used until this step and every care should be taken not to leave epidermis in the canal. Then, the whole flap which consists of meatal skin, annulus and TM (glove finger flap) is removed and preserved in saline solution.

A wide canalplasty, if required can be performed after removal of the glove finger flap, in order to get complete exposure of the tumour. Tumour removal starts from the mesotympanum and then proceeds to the anterior tympanum, hypotympanum, and posterior tympanum respectively. Bipolar cautery is used to shrink and mobilize the tumour in the middle ear. Monopolar cautery is not recommended because it can cause electrical trauma to the cochlea. The vascular pedicle (inferior tympanic branch of the ascending pharyngeal artery) is coagulated carefully during these manoeuvres. Sometimes the artery can be found in a bony canal, in which case the bony canal is drilled with a large diamond burr to stop the bleeding. Tumour removal from the posterior mesotympanum (around the stapes, oval and round window area) is kept as the last step of the surgery because by that time enough room has been created for dissection and tumour removal can be done with ease and without disrupting the ossicular chain. A small hole is created in the temporal fascia (harvested at the beginning of the procedure) to pass the handle of the malleus. The handle of the malleus is inserted through this hole. Both these manoeuvres reduce the risk of lateralization of the TM. The graft is placed under the bony annulus as in the underlay technique after packing the tympanic cavity with gel foam. The glove finger flap is carefully replaced over the graft adapting it to the enlarged external auditory canal through some radial skin incisions. The replaced glove finger flap is secured in place

TABLE II  
PRE-OPERATIVE HEARING STATUS

Type	Patients (n (%))	Mean PTA (Bone, dB)
Normal	11 (68.7)	12.5
CHL	02 (12.5)	20.6
SNHL	02 (12.5)	28.7
Mixed	01 (6.2)	22.5

CHL = Conductive hearing loss; SNHL = Sensori-neural hearing loss; PTA = Pure tone average

TABLE III  
POST-OPERATIVE HEARING RESULTS (N = 16)

Type	Patients (n (%))	Mean PTA (dB)	
		AC	BC
Normal	11 (68.7)	23.8	15.3
CHL	03 (27.2)	45.8	22.9
Mixed	01 (6.2)	45	30
SNHL	01 (6.2)	48.7	36.2

PTA = Pure tone average; AC = Air conduction; BC = Bone conduction; CHL = Conductive hearing loss; SNHL = Sensorineural hearing loss

with gel foam. Replacement of the posterior meatal skin in the correct position completes the surgical procedure.

## Results

Of the 17 charts reviewed, all were histopathologically confirmed glomus tumours. The patients' ages ranged from 24 to 75 years (mean age 49.1 years). All the patients were female (100 per cent). The mean follow up was 28.7 months, range from one month to 120 months.

Pulsatile tinnitus was the most common presenting symptom occurring in 12 patients (70.6 per cent). Clinical symptoms are summarized in Table I. A single symptom was found in nine patients (52.9 per cent) while multiple symptoms were found in eight patients (47.1 per cent).

On physical examination all patients were found to have a retrotympanic mass that was dark red in colour. Ten patients (58.8 per cent) had the tumour in their left ear and seven (41.2 per cent) had it in the right ear. When staging was done there were 12 cases (70.6 per cent) of Class A1 and five cases (29.4 per cent) of Class A2. Pre- and post-operative audiograms were available of all the patients, but one patient was not included in the results because she had an ipsilateral dead ear pre-operatively. Pre-operative audiogram findings are summarized in Table II. The pre-operation average air conduction (AC) was 27.5 dB and bone conduction (BC) was 20.1 dB. The post-operative audiogram showed normal hearing in 11 patients (68.7 per cent), a conductive hearing loss in three patients (18.7 per cent), mixed hearing loss in one patient (6.2 per cent) and sensorineural hearing loss in one patient (6.2 per cent) (Table III). CT scan was done in 12 patients (70.6 per cent), eight of whom had findings consistent with glomus tympanicum (47.1 per cent). MRI was performed in two patients. All the patients were primary cases. In one case (5.8 per cent) there was recurrence after nine years, for which the patient was re-operated. All the tumours were managed surgically under local/general anaesthesia. In eight patients (47.1 per cent) the retroauricular trans canal (RATC) technique was used, while RATC (modified technique) was used in five patients (29.4 per cent) and four patients (23.5 per cent) underwent the endocanal (stapedectomy type) approach.

A mass in the hypo- and meso-tympanum was the most common operative finding and was seen in seven patients (41.2 per cent), followed by a



TABLE IV  
POST-OPERATIVE COMPLICATIONS

Complications	n (%)
No complication	12 (70.6)
Perforation of TM	02 (11.8)
Stenosis of EAC	02 (11.8)
Recurrence	01 (5.8)

hypotympanic mass in five patients (29.4 per cent) and mesotympanic mass in four patients (23.5 per cent). In one patient (5.9 per cent) the mass was found to be filling the whole middle-ear cleft. Complete removal of the tumour was achieved in all the cases (Figure 3). The ossicular chain was intact in all the patients. Out of five cases of class A2, four were operated on by the modified approach and one with the usual technique of the retroauricular trans-canal approach. Out of the four cases, operated on by the modified technique complete tumour removal was achieved in all without disrupting the ossicular chain. Post-operatively healing was good. A pinhole perforation occurred in one patient, which healed spontaneously.

Post-operative complications as a whole are summarized in Table IV. Of two patients in whom TM perforation occurred after the operation, one was operated for tympanoplasty and the second one healed on its own.

## Discussion

Glomus tumours (chemodectomas) arising from the glomus body, were first described by Guild.<sup>16</sup> The term glomus tympanicum is reserved for tumours that originate from the mesotympanum while the term glomus jugulare is attributed to those cases that arise from the jugular bulb or the hypotympanum with secondary invasion of the jugular bulb.

As stated in the literature<sup>3,13</sup> and also in our series, the initial symptoms are pulsatile tinnitus synchronous with the pulse, hearing loss (conductive,



FIG. 3

Post-operative CT scan showing complete removal of the tumour with intact tympanic membrane and wide canal plasty.

sensorineural or mixed) and otalgia. A predominance of female patients has been mentioned in the literature<sup>3,13</sup> however in our series it was absolute since all the patients were female. On otoscopy, a retro-tympanic mass is seen in the inferior quadrant that is usually red or Bordeaux-red, but may have a reddish-blue colour. O'Leary *et al.* have reported as many as 11 per cent in whom the tumour can be seen completely through the TM, but in our series it was higher i.e. 70.6 per cent.

- **Glomus tympanicum is one of the commonest neoplasms of the middle ear**
- **The most common presenting symptom is pulsatile tinnitus**
- **A retrotympanic mass is found in the middle ear in all cases**
- **Surgery is the gold standard of treatment**
- **17 cases treated by a simple, safe surgical technique are described**
- **Surgery has the advantage of complete removal, low complication rate, low recurrence rate, acceptable hearing levels and minimum morbidity**

The diagnosis can be made clinically. HRCT scan with contrast allows exact definition of the tumour extension in relation to bone and MRI with gadolinium gives additional information regarding the involvement of adjacent soft tissue structures by the tumour. According to Fisch's classification the glomus tympanicum tumour corresponds to class A tumours. Once the tumour class and its extent are properly determined, precise pre-operative planning will allow conservative surgery. From experience, it seems that a surgical cure of glomus tympanicum with less morbidity is superior to primary radiotherapy.<sup>13</sup>

In the last 10 years, this technical concept has been applied in cases of glomus tympanicum tumours in our institution. Class B tumours are treated through the extended facial recess while class C and D are managed by the infratemporal fossa approach.

Our technique allows a wide exposure of the tumour through the ear canal and gives better control of the ossicular chain and facial nerve. Canalplasty associated with the glove finger skin flap removal is not time consuming and is a simple procedure for middle-ear surgeons to perform. Cautery is never used before the removal of the flap. This ensures good viability of the flap and improves wound healing in the post-operative period. The glove finger skin flap removal permits a better exposure and dissection of the windows' area and the facial nerve, thus ensuring complete removal and reducing chances of injury to the above mentioned structures. It also facilitates the use of bipolar cautery without injuring the meatal skin. None of the cases required the wider approach

(extended facial recess or canal wall down) as reported in the literature.<sup>3,13</sup> Forest *et al.* reported that in 23 patients ossicles were removed and in 11 patients ossiculoplasty was done in the same sitting, while in our series we managed to keep the ossicular chain intact in all the cases. In this series we have operated four cases of Class A2 by our technique and achieved total removal of tumour with no recurrence, an acceptable hearing threshold and little morbidity. Only one complication of a pin hole perforation was encountered, which healed on its own. The recurrence rate was 5.9 per cent, which is comparable to the literature.<sup>3,12</sup>

## Conclusion

The typical glomus tympanicum patient presents with pulsatile tinnitus and a retrotympenic mass on examination. No biopsy should be taken from the mass. HRCT with contrast should be performed to evaluate the extent of the tumour. MRI has not been of much benefit in the cases of glomus tympanicum, but it can be performed if the CT scan does not show clearly the involvement of adjacent structures such as the jugular bulb or carotid artery. Complete surgical excision of the tumour is the treatment of choice with acceptable recurrence rates, low morbidity, no mortality and satisfactorily dependable hearing preservation until there is contraindication to it. Radiation therapy can be considered in cases of recurrence and as a second option to the patients. Early diagnosis and prompt treatment should allow the avoidance of unnecessary radical procedures in which hearing can not be preserved.

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