

# SURGICAL MANAGEMENT OF GLOMUS TYMPANICUM TUMOR

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**Abstract :** Glomus tympanicum tumor (also known as paraganglioma or chemodectoma) is the most benign tumor of temporal bone. Treatment may be palliative or curative. Palliative therapy includes watchful observation or radiotherapy and curative treatment is surgical. During 1995 to 2005, 18 cases of glomus tympanicum were managed at Basavanagudi ENT Care Centre Bangalore. We review retrospectively the diagnosis and surgical management of these cases. Advances in the imaging and refinements in traditional surgery have made correct diagnosis and complete excision of these tumors possible in most of the cases.

**Keywords :** Glomus tympanicum, post-auricular transcanal tympanotomy (PATT), open cavity mastoidectomy

## INTRODUCTION

Glomus tympanicum arise from paraganglions, which are chief cells of neural crest origin found in close association with sympathetic ganglions along the aorta, and it's main branches. Therefore they are also known as paragangliomas or chemodectomas. The term glomus is a misnomer<sup>1</sup>. However, the clinical terms glomus tympanicum and glomus jugulare are more commonly used and have advantage of identifying the particular type of tumor, the management of each type often being different.

Glomus tympanicum tumor originates from paragangliomas along the tympanic segment of Jacobson's (IXth) nerve or along the Arnold's (Xth) nerve in the middle ear. They have a tendency to multi-centricity with incidence of 25-50% in familial cases and 10% in non-familial cases<sup>2</sup>. As these tumors are derived from non-chromaffin paraganglia, they do not normally have any endocrine activity. They are generally benign with local invasion. Glomus tumors rarely exhibit malignant degeneration, with commonly cited figure at 4%.<sup>3</sup>

## MATERIALS AND METHODS

This is a retrospective study of 18 patients of glomus tympanicum diagnosed at Basavanagudi ENT Care Centre, Bangalore between 1995 to 2005. The patients were categorized by age, sex, presenting signs and symptoms, side of tumor, audiometry and radiological work up which varied from simple CT scan to HRCT with or

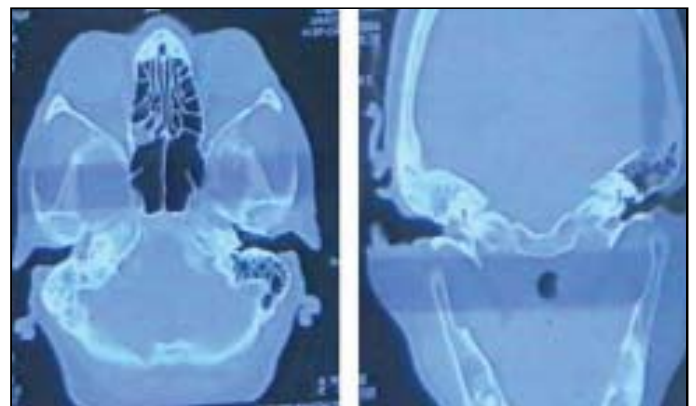
without MRI with gadolinium depending on availability, affordability and necessity (in case of MRI). Three of the patients were previously operated at other centers and had presented to us with recurrence. Patients were divided into various subtypes according to Glasscock and Jackson classification based on radiological and pre-operative findings. All the cases were operated by senior author (AM) under local anesthesia. All patients underwent resection of tumor by one of the two approaches: post-auricular transcanal tympanotomy (PATT) approach with or without atticotomy and open cavity mastoidectomy with tympanoplasty based on tumor classification. Intra-operative findings were recorded precisely and any operative complication immediate or delayed was noted. The patients were followed up with a minimum follow up of one year and maximum of eight years. Follow up audiograms were done after one year and were available in fourteen of these patients. Pre-operative and post-operative pure tone averages were computed for air and bone at 0.5, 1.0 and 2.0 kHz for comparison.

## SURGICAL TECHNIQUES

Based on clinical and radiological evaluation patients were graded according to Glasscock - Jackson classification. Patients with revision surgery were classified based on current evaluation. All the cases were started by PATT approach and suitable mastoidectomy was performed as per intra-operative findings.



**Fig. I** Showing vascular mass behind the intact tympanic membrane. (A) Glomus tympanicum with Circumferential margins seen (b) Glomus tympanicum involving entire mesotympanum



**Fig. II** Showing pre-operative CT Scan. (a) Axial CT Scan showing glomus tympanicum in middle ear (b) Coronal CT Scan showing presence of bone tumor and jugular bulb.

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## POST-AURICULAR TRANSCANAL TYMPANOTOMY (PATT) APPROACH

Through the external canal a posterior meatal skin flap is developed and elevated. A post-auricular incision is made and the posterior meatal flap is separated from bony meatus. A semicircular tympanomeatal flap is elevated along with the tympanic membrane from 2 o'clock to 5 o'clock position for the right ear and 10 o'clock to 5 o'clock position for the left ear separating it from the malleus handle by sharp dissection. The tumor is usually free from the tympanic membrane. Sharp dissection could separate it from the tympanic membrane if adherent to it. If the tumor is destroying the tympanic membrane and coming into the canal it can be removed along with the tympanic membrane. The tympanomeatal flap is pushed into anterior sulcus. Canalplasty is done as per necessity so as to give clear view of entire bony sulcus. Posterior bony sulcus is also removed if required to further expose the tumor.

The tumor is now coagulated ("cooked") by using bipolar cautery so as to shrink it in size (Fig. 1) and prevent profuse bleeding. The tumor excision starts in hypotympanum followed by anterior mesotympanum. The feeding vessel (inferior tympanic artery) is coagulated alongside the Jacobson's nerve. If the tumor is restricted to mesotympanum, it is usually possible to excise it using a micro-scissors (Fig. 2) with intact ossicular chain. However if it is extending into epitympanum, it is necessary to dislocate incudostapedial joint and remove the incus.

Sometimes, the stapes suprastructure may be resected with a micro scissors to enable complete tumor removal without damaging the footplate and thus preventing both sensorineural hearing loss and recurrence of the tumor. Atticotomy may be required for lesions involving epitympanum. Ossiculoplasty is performed simultaneously with autogenic incus or malleus depending on presence or absence of suprastructure respectively. Ossiculoplasty may be deferred for second stage if there is extensive damage to middle ear mucosa or if there is doubtful residual tumor at eustachian tube area. If the tympanic membrane is damaged, rehydrated temporalis fascia is placed under the remnant TM and over the malleus handle. Posterior meatal flap is

repositioned and canal packed with gelfoam soaked in antibiotic solution.

## OPEN/CLOSED CAVITY MASTOIDECTOMY WITH TYMPANOPLASTY

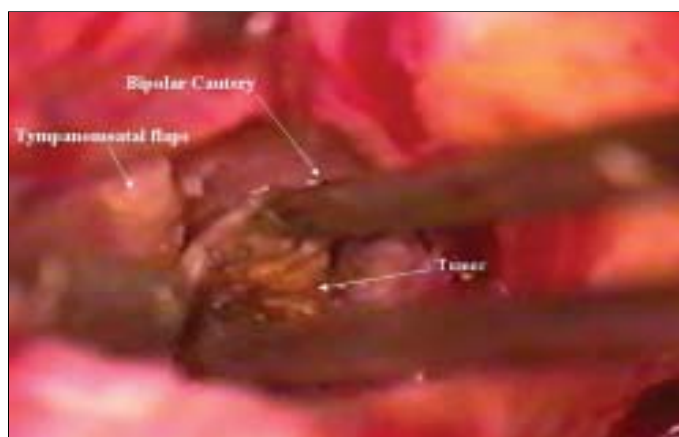
The patients with involvement of attic and antrum along with the middle ear underwent modified intact canal wall mastoidectomy with removal of tumor from mastoid air cells and attic by wide atticotomy and posterior canal widening. The decision to bring the canal wall down was done if the mastoid was involved, the external auditory canal was eroded by the tumor or the there was extension of the tumor into anterior epitympanum. Care was taken to rehabilitate open cavity so that there were no cavity problems.

## RESULTS

The patients' ages ranged from 22 to 69 years with a mean of 43.5 years. 14 of the 18 (78%) patients were in the age group of 30 to 60 years. 16 (89%) of our patients were female. The difference between right and left ears (55% right, 45% left) was not statistically significant. Presenting symptoms ranged from just fullness in the ear to frank bleeding from the ear. The frequency and range of symptoms in our patients are summarized in Table I. Pulsatile tinnitus is the most common symptom found in 14(78%) of our patients. However, it was usually unnoticed with other symptoms in 12(86%) out of these 14 patients. Hearing loss or fullness also was a frequent symptom. 6(38%) of our patients had blood stained discharge or fresh bleeding from ear when they first presented to us suggesting a relatively late presentation. The mean period between onset of symptoms and presentation was two and half years with a range from one and half month to 20

**TABLE 1**

Presenting Symptom	Number of Patients (in %)
Hearing loss	9 (50)
Fullness in ear	3 (17)
Tinnitus	14 (78)
Vertigo	3 (17)
Earache	4 (22)
Bleeding/Discharge	6 (34)



**Fig. III** Showing use of bipolar cautery to "cook" the tumor.



**Fig. IV** Showing use of microscissors to excise the "cooked" tumor.

years. On examination, a vascular mass behind the intact tympanic membrane was found in 11 of the patients (Fig. 3). However, not all of these patients had positive Brown's pulsation sign, which is blanching of the mass on seigelization. 4 of these were localized to hypotympanum having "sun rise" appearance, while rest of them involved entire mesotympanum. 6 of the patients had a polypoidal pulsatile mass in external auditory canal. None of the patients had symptoms or signs that can be attributed to either neurosecretory tumor or involvement of lower cranial nerves.

Pre- and post-operative audiogram results are summarized in Table 2. Note that post-operative results were available in 11 of the patients with hearing ears. 3 patients had dead ear pre-operatively. 2 of the patients were advised second stage ossiculoplasty but later deferred, as their other ear was normal. These 5 patients were not considered in post-operative hearing evaluation. 2 patients did not have post-operative PTA. Out of 11 patients analyzed with PTA, 2 had normal hearing, 6 had conductive, 2 had mixed and 1 had severe sensorineural hearing loss before surgery. Post-operative PTA revealed normal hearing in 5 patients and conductive hearing loss in 3 patients. 2 patients with mixed hearing loss had closure of AB gap within 10 dB. 1 patient with severe sensorineural hearing loss had no response on post-operative evaluation.

Ten of the patients were classified into type I and II tumors and eight had type III and IV tumors (Table 3). All the ten patients with Type I and II tumors and one with Type IV tumor were excised by PATT approach with ossiculoplasty performed if necessary simultaneously or as a staged procedure depending on the status of mucosa of the tubotympanum. Seven patients with Type III and IV tumors were excised by closed or open cavity mastoidectomy with suitable tympanoplasty. Of the seven patients undergoing canal wall down mastoidectomy with tympanoplasty, 3 were revision surgery with one of them having open cavity and another having unsalvageable posterior canal defect. 4 of them had involvement of mastoid air cells with extensive involvement of EAC and therefore ICW mastoidectomy was not satisfactory. 4 of the open cavity patients already had dead ear due to erosion of vestibule in 2 of them and cochlea in one. In one of the patient, ICA bony covering was eroded and tumor attached to adventitia. So, no tympanoplasty was done in these cases.

All the patients had complete removal and none of the patients had recurrence during the follow up period ranging from 1 year to 10 years. One of the patients had transient postoperative facial paralysis, which recovered completely over two weeks. All the patients had dry ears with healed tympanic membrane/epithelialized cavity without any cavity problems.

## DISCUSSION

Since the glomus tympanicum tumors are slow growing, the patients are often diagnosed late when they are quite extensive. The mode of presentation depends on the type and extent of the tumor but most of them complain of pulsatile tinnitus, hearing loss and earache. Some of them do present with bleeding from the ear. Otoscopy reveals vascular mass behind the intact tympanic membrane or in external auditory canal. Unless all the margins of vascular mass behind intact tympanic membrane are clearly visible, differentiation of glomus tympanicum from jugulare is not clinically possible (Fig. 3). Blanching of tympanic membrane on pneumatic otoscopy (Brown's sign) is not always present<sup>5</sup>. A high jugular bulb and an aberrant carotid artery are important differential diagnosis. So, myringotomy and biopsy are strictly prohibited. The pure tone audiometry may reveal conductive, mixed or sensorineural hearing loss depending on the extent of the tumor.

The mainstay of glomus tumor diagnosis is radiological. Imaging plays the most important role in determining the type of disease (tympanicum vs. jugulare) and its extent. High resolution computed tomography (HRCT) of temporal bone is the initial modality of choice. The presence of air or bone between the tumor and jugular bulb characterizes the mass as a tympanicum tumor (Fig. 4). HRCT temporal bone is helpful in evaluating the extent of lesion as well as possible involvement of facial nerve, carotid artery and jugular bulb. MRI with gadolinium DTPA may be valuable when involvement of jugular bulb and carotid artery is doubtful and to rule out multicentricity<sup>4</sup>.

Angiography is not routinely required for confirmed glomus tympanicum unless embolization is considered. All patients with glomus tympanicum tumors need not undergo catecholamines screening unless patient is exhibiting symptoms similar to pheochromocytoma or has positive family history of neurosecretory tumors<sup>5</sup>.

TABLE 2

TYPE OF HEARING LOSS (HL)		PRE-OPERATIVE STATUS		POST-OPERATIVE STATUS		
	NUMBER OF PATIENTS	MEAN AC	MEAN AB GAP	NUMBER OF PATIENTS	MEAN AC	MEAN AB GAP
Normal Hearing	2	22	10	5	20	8
Conductive HL	9	41	27	3	40	25
Mixed HL	3	62	27	-	-	-
Sensorineural HL-moderate	-	-	-	2	47	5
Sensorineural HL – severe to profound	4	NR	NR	4	NR	NR

A glomus tumor classification is necessary for surgical planning and provides standards for reporting surgical results. Oldring and Fisch<sup>6</sup> proposed a classification that did not consider tympanic and jugulare lesion separately. We follow Glasscock-Jackson classification<sup>7</sup> that retains the familiar and clinically useful tympanic and jugulare subclasses, expanding subclasses by tumor extent. Glomus tympanicum subclass is divided into four subtypes.

Type I: Small mass limited to promontory.

Type II: Tumor completely filling middle ear.

Type III: Tumor filling middle ear and extending into mastoid process.

Type IV: Tumor filling middle ear, extending into mastoid or through tympanic membrane to fill external auditory canal; may extend anterior to internal carotid artery.

Surgical technique followed by us for type I and II tumors do not require the usual extended facial recess approach. A wide canaloplasty with atticotomy if required gives maximum exposure. Use of Bipolar cautery minimizes bleeding and ensures complete

removal with usual sharp dissection techniques. We usually do inlay temporalis fascia grafting to prevent residual perforation and lateralization. Similar technique with onlay grafting has been recently reported<sup>8</sup>. Though 4 of these required ossicular removal, it could be corrected by ossiculoplasty. But it ensured complete removal and no recurrence.

Open cavity mastoidectomy has been used infrequently nowadays for glomus tympanicum. However, O'leary et al<sup>5</sup> and Jackson CG et al<sup>4</sup> agrees that though CWD format is an outdated concept, they required CWD procedures in some of their patients with extensive canal wall destruction or for exposure. We believe it is still a valuable requirement especially for cases with late presentation involving the mastoid or in revision cases.

## SUMMARY

Glomus Tympanicum is a benign tumor, slowly progressive in nature. Early diagnosis and proper surgical treatment allows complete excision with good hearing. However, no glomus tympanicum is technically unresectable. Open cavity technique improves complete excision without recurrence in type III & IV tumors. However, hearing is often compromised in such cases.

**Table 3**

GLASSCOCK JACKSON	NUMBER OF PATIENTS	MODE OF MANAGEMENT	
TYPE		PATT APPROACH	OPEN CAVITY TYMPANOMASTOIDECTOMY
TYPE I & II	10	10	-
TYPE III & IV	8	1	7

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