### Abstract

**Objective**
- To compare pharmacological and surgical management options in order to define an optimal treatment algorithm

**Study Design**
- Case series report using retrospective chart review of patients with objective tinnitus from 2000 to 2013

**Results**
- Majority of symptoms were ameliorated with pharmacological treatment such as carbamazepine.
- Eighteen percent of patients underwent surgical intervention with stapedial and tensor tympani tendon lysis (mean age = 58.5 years).
- On follow up, only 33% of postoperative patients had resolution of symptoms.

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### Methods and Materials

**Retrospective chart review of patients diagnosed with objective tinnitus from January 2000 to April 2013**

- Identified by ICD9 diagnoses of unspecified tinnitus (code 388.3) and focal myoclonus (code 333.2).
- Excluded objective tinnitus of other etiologies such as vascular anomalies, palatal myoclonus, patulous eustachian tube, etc.

We then examined the following in detail:
- Those requiring treatment versus observation
- Time course and effectiveness of pharmacological and surgical interventions

Primary analysis was descriptive, conducted using Excel and standard SPSS software.

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### Introduction

Tinnitus can be divided into subjective and objective tinnitus.

**Subjective tinnitus**
- Associated with sensorineural hearing loss
- Injury from hair cells that result in abnormal, spontaneous activity within the auditory pathways

**Objective tinnitus**
- Patulous Eustachian tube
- Temporomandibular joint clicks or crepitus
- Vascular anomalies
- Palatal and middle ear myoclonus (Goz et al 2003)

Middle ear myoclonus (MEM) is a mechanical phenomenon from contraction of the stapedius and/or tensor tympani muscle(s), creating a repetitive buzzing, clicking sound either from the muscle contraction itself or from the movement of the tympanic membrane.

MEM has been treated both pharmacologically and surgically with variable outcomes. Pharmacological treatment does not completely ameliorate symptoms but only subdues the tinnitus to tolerable levels.

Of the surgical cases in a systematic review of 21 articles by Bhimrao et al., all had resolution of symptoms except one, who had a component of palatal myoclonus. However, follow up tends to be variable and no larger case series have been reported on the comparison of pharmacological and surgical outcomes.

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### Results

A total of 60 patients met criteria for middle ear myoclonus. 45% of them had transient symptoms, and 55% had sustained symptoms with a mean duration of 12.8 months, described most commonly as a fluttering sound. 57% of patients were female. Symptoms were ameliorated with pharmacological treatment such as carbamazepine for follow up duration as long as 6 years in 75% of patients.

Six patients underwent surgical intervention of stapedial and tensor tympani tendon lysis (mean age = 58.5). On follow up, only 2 postoperative patients or 33% of surgical patients had complete resolution of symptoms.

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### Discussion

Majority of literature on MEM highlight the success of surgery. However, in our study, surgery was only successful in one-third of patients. The majority of symptoms were controlled on pharmacological treatment such as carbamazepine. However, this medication has been linked to severe adverse reactions such as pancytopenia and aplastic anemia and requires close monitoring. Other pharmacological considerations with better side effect profiles include:
- Benzodiazepines
- Orphenadrine citrate
- Oxcarbazepine
- Levetiracetam

**Limitations**
- 1) Follow-up duration of postoperative patients
- 2) Data collection gaps transitioning from paper to electronic medical records during the study period

**Future directions:** Longer duration of follow up and increasing power by collaborating with other medical centers

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### Conclusions

Half of middle ear myoclonus cases spontaneously resolve, and the other half requires a combination of pharmacological and surgical therapies. However, surgical intervention has not proved to be as successful as suggested in the current literature, and more effective management modalities need to be elucidated.

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