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AN OBSERVATIONAL STUDY OF IMAGING FINDINGS IN PATIENTS REFERRED FOR EVALUATION OF TINNITUS

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ABSTRACT

Tinnitus is a complex hyperactive neural disease. It constitutes perceived sounds in the absence of external noise, like that of auditory hallucinations. The study was conducted on patients presenting with tinnitus. They were evaluated by CT and MRI for presence of pathological findings. The data is presented in a tabular form and discussed herewith.

KEYWORDS: The study was conducted on patients presenting with tinnitus.

INTRODUCTION

Tinnitus is a complex hyperactive neural disease. It constitutes perceived sounds in the absence of external noise, like that of auditory hallucinations. The term tinnitus originates from the Latin word “tinnire”, which means “to ring.” The tinnitus sounds are described as a ringing, buzzing or whistling tone. They are rarely comparable to natural sounds or those synthesized electronically.[1-3]

The impact of tinnitus on an individual vary widely from person to person and for the different kinds of tinnitus. It often fluctuates with time and with differing circumstances. It may result in concentration difficulty, annoyance, insomnia, anxiety, depression, and, in some extreme cases, may lead to suicide. In some people, it is experienced only when silent, for example, placed in a silent room for audiological testing. Most forms of tinnitus will be in

the range of 20dB (Decibel) even in times when the tinnitus is considered as unbearable. Severe tinnitus, is often accompanied by abnormal perception of physical sounds such as hyperacusis and may cause phonophobia or depression. There are no known objective tests that detect whether a patient is having tinnitus or not and also for determining the severity of tinnitus.[1,4]

The prevalence of tinnitus varies as different studies employed different definitions. It affects 10% of the general population in the USA (United States of America). The incidence of tinnitus increases with age and in those exposed to loud noise. It is most prevalent between 40 and 70 years of age. Between 7.6 and 20.1% of individuals above the age of 50 years, have tinnitus. The men and women have roughly equal prevalence, and can occur in children.

Two kinds of tinnitus, objective and subjective can be identified. Objective tinnitus result from the sounds generated in the body that are conducted to the ear. They may be caused by muscle contractions or blood flow turbulence. It may be detected by an observer using auscultation. The causes of objective tinnitus can be found by ancillary investigations, with usually a finding of genuine physical source of sound. Subjective tinnitus, the most common kind of tinnitus, is a broad group of sensations that are caused by abnormal neural activity in the nervous system that is not elicited by sound activation of sensory cells in the cochlea. The abnormal neural activity may be elevated spontaneous neuronal firing rate and increased neuronal synchronization caused by the auditory deprivation, changes in the tonotopic map, auditory cortical reorganization, dysregulation of the limbic system, and the central auditory cortex. However, the etiology of subjective tinnitus often lies in otologic disorders that also lead to conductive or sensorineural hearing loss. Conductive hearing loss caused by impaction of cerumen, external or internal otitis, cholesteatoma, ossicular chain abnormalities, or tympanic membrane perforation may be associated with subjective tinnitus.[4, 6-10]

Tinnitus can also be constant or pulsatile. In pulsatile tinnitus, the tinnitus is repetitively synchronous to the patient's heartbeat. All other tinnitus sounds are regarded as non-pulsatile. Less than 10% of individuals with tinnitus have pulsatile type. Pulsatile tinnitus requires hearing, as there is usually a genuine physical source of sound. Pulsatile tinnitus is therefore included under the umbrella terms "physical tinnitus" and "somatosounds." Nonpulsatile tinnitus is almost always subjective, whereas pulsatile tinnitus can be subjective or objective.

About 70% of the cases with pulsatile tinnitus have an underlying cause that can be identified by adequate diagnostic work-up.

Patient's own description serve as a basis for a clinical evaluation. Detailed tinnitus inquiry, tinnitus matching, audiometric tests, and neuropsychological assessment may help. Neuroimaging methods provide some information in the brain of individuals with tinnitus. Electrophysiologic tests (electroencephalography, EEG, and magnetoencephalography, MEG) help in providing some information about plastic changes in the brain. Currently, there is no golden standard treatment or drug for tinnitus. However, counseling, pharmacological approaches, individualized sound stimulation, masking devices, and psychotherapy in the form of cognitive behavioral therapy (CBT) are the most widely used strategies.[4,5,1]

OBJECTIVES

1) Evaluating the role of MRI & CT in patient suffering from Tinnitus.
2) To describe in detail various positive findings in patient with tinnitus based on MRI & CT imaging.

The study was conducted in the department of Radiology at an academic tertiary care center in Mumbai, from Oct 2019 to Mar 2021 (18 months). This was a hospital-based, observational, descriptive, cross-sectional study. A sample of 40 patients visiting the hospital complaining of tinnitus. 40 patients with tinnitus were selected by universal sampling method & evaluated by MRI & CT. The study was approved by the institutional ethics committee.

INCLUSION CRITERIA

1. Patients presenting with tinnitus.
2. Patients with age greater than 18 years.
3. Patient who gave informed consent.

EXCLUSION CRITERIA

1. Patients with comorbid conditions like malignancy/ critically ill patients requiring continuous monitoring.
2. Uncooperative patients.
3. Pregnancy.
4. Patients with age less than 18years.

TOOLS

a) Imaging protocol: equipment

1)1.5 Tesla MRI machine - Philips medical system model number 43000-603.

2) Multi-detector -16 slice SIEMENS SOMATOM scope CT SCAN.

b) Method of CT and MRI imaging in patient presenting with tinnitus: Standard imaging investigations for CPA or IAM (Internal Auditory canal or meatus) mass lesions – T1WI, T2WI axial, T2 sag, 3D FLAIR, Axial GRE, DWI. Additional pre and post gadolinium 3D T1-weighted -Spin -echo images. 3DFT-CISS sequence was also done.

CT images - 16 slice scanner with high resolution CT (HRCT) for temporal bone in axial section with 0.6 mm thin sections with reconstruction in coronal and sagittal view.

Statistics

The data were compiled using Excel sheet and SPSS (Statistical Package for the Social Sciences) version 25 was used for calculating the measures of central tendency and variability. The data were recorded in the form of mean and standard deviation for continuous variables and frequency and percentage for categorical variables.

RESULTS

The results were evaluated and statistically presented here. In our study, 28 (70%) of 40 patients with tinnitus were males, while 12 (30%) were females as shown in Table 1 and figure 1.

Table 1: Data showing the distribution of gender among the patients with tinnitus.

Gender	Frequency	Percent
Male	28	70.0
Female	12	30.0
Total	40	100.0

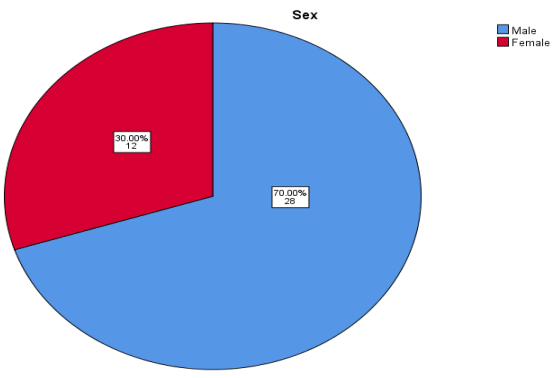

Figure 1: Data showing the distribution of gender among the patients with tinnitus.

Table 2: Data showing the details of age distribution among patients with tinnitus.

Age Distribution					
	N	Minimum	Maximum	Mean	Std. Deviation
Age(in years)	40	20	77	48.07	16.951

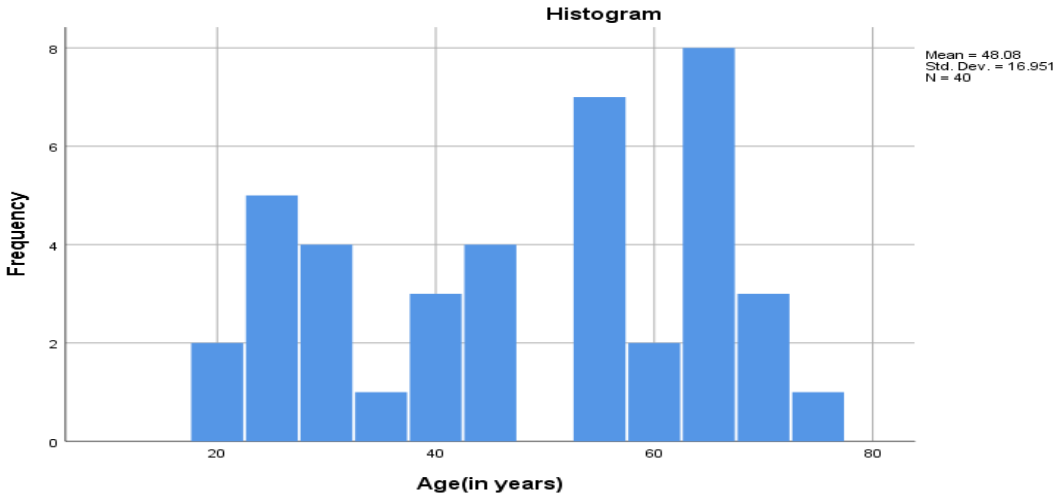

Figure 2: Data showing the details of age distribution among patients with tinnitus.

In the present study, the mean age was 48 years with SD (standard deviation) of ±17 years. The minimum age was 20 years and maximum was 77 years as shown in Table 2 and Figure 2.

Table 3: Data showing the details of presence of tinnitus among patients.

Tinnitus	Frequency	Percent
Left	18	45.0
Right	17	42.5
Bilateral	5	12.5
Total	40	100.0

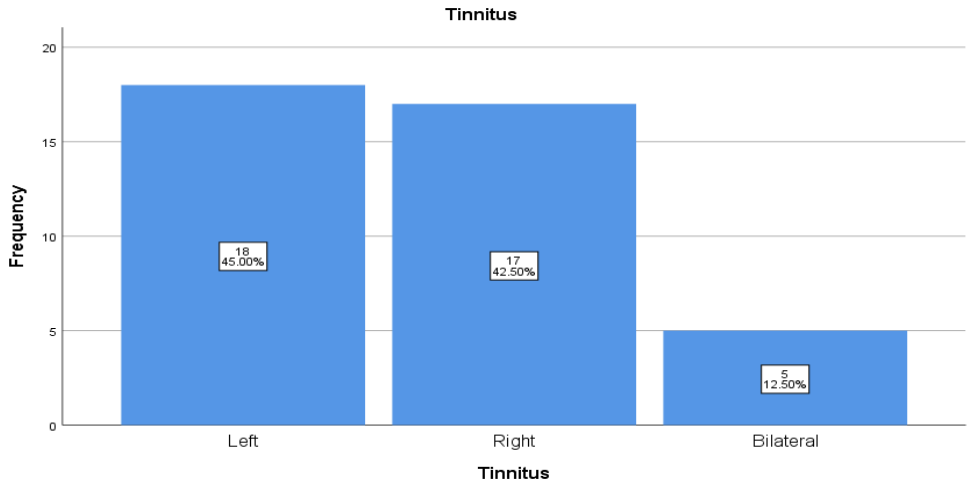

Figure 3: Data showing the details of presence of tinnitus among patients.

In the study, about 45% of the patients (18 out of 40) presented with tinnitus on left side, while 17 patients presented on right side, and 5 patients presented bilaterally as shown in Table 3 and figure 3.

Table 4: Data showing the details of hearing loss in patients presenting with tinnitus.

Hearing loss	Frequency	Percent
No	26	65.0
Left	5	12.5
Right	8	20.0
Bilareral	1	2.5
Total	40	100.0

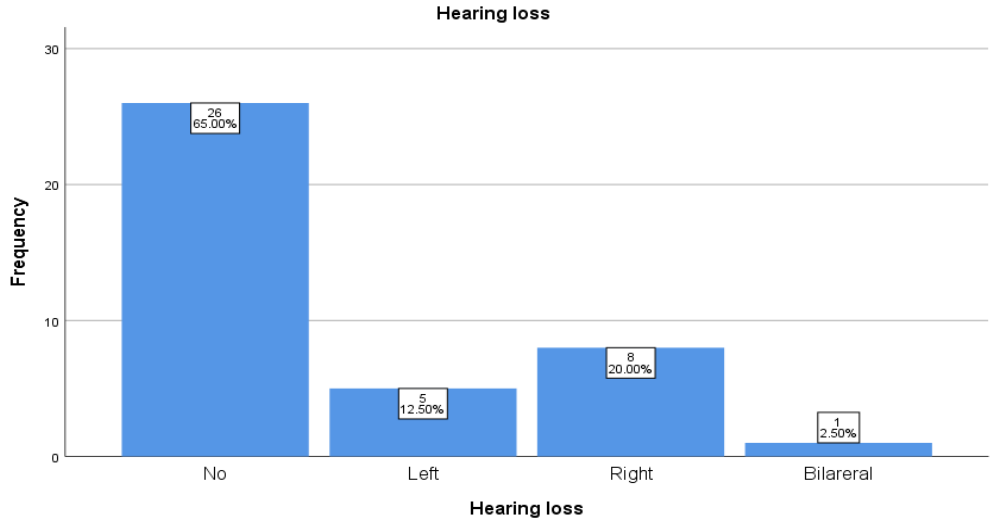

Figure 4: Data showing the details of hearing loss in patients presenting with tinnitus.

In our study, hearing loss was absent in 65% (26 out of 40) patients. About 20% (8 patients) had on right side, while 5 patients had on left side and 1 patient had bilateral hearing loss as shown in Table 4 and figure 4.

Table 5: Data showing the history details of patients with tinnitus.

		Count	**Column N %**
Relevant past history	**Nil**	**38**	**95.0%**
	Present	2	5.0%
H/O Hypertension	No	37	92.5%
	Yes	3	7.5%
Past medication history	No	40	100.0%
	Yes	0	0.0%
H/O Trauma	No	40	100.0%
	Yes	0	0.0%
H/O Ear infections	No	39	97.5%
	Yes	1	2.5%

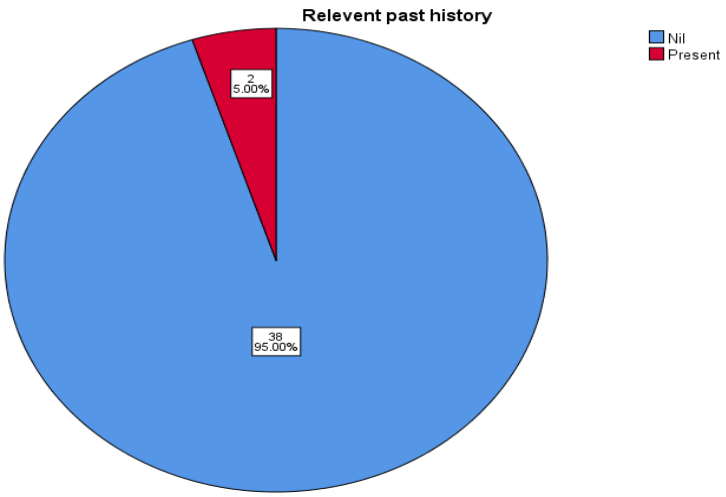

Figure 5a: Data showing the details of similar past history in patients with tinnitus.

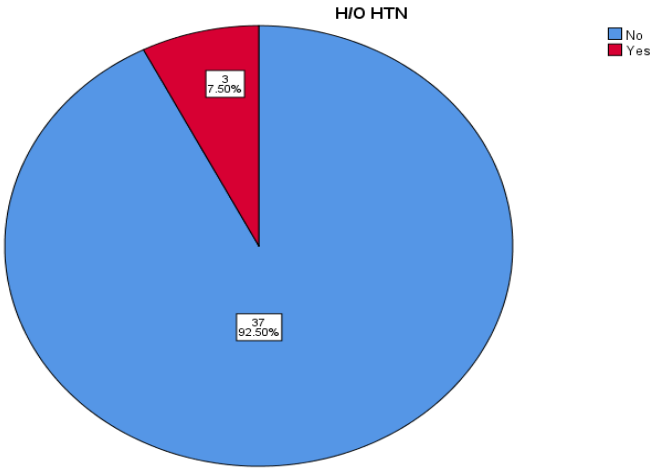

Figure 5b: Data showing the details of comorbid hypertension in patients with tinnitus.

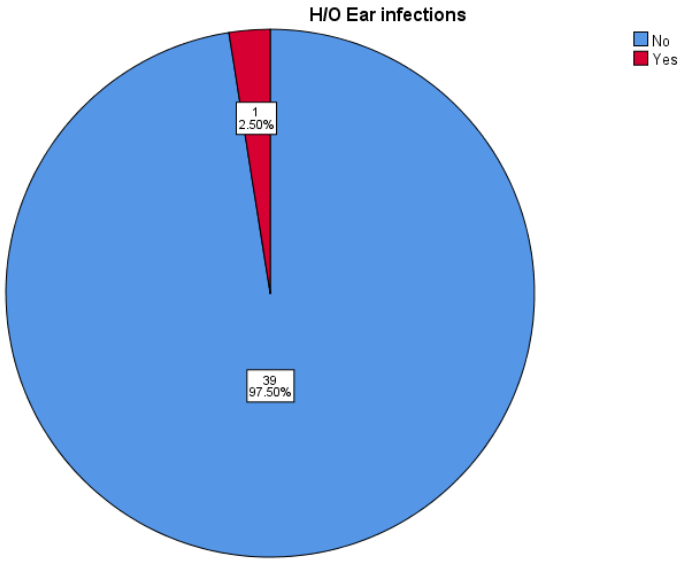

Figure 5c: Data showing the details of associated ear infection in patients with tinnitus.

In our study, similar presenting complaints were also present in the past in 2 patients (5%). About 3 patients had hypertension. No patient had trauma or on medications. One patient had associated ear infection. The relevant past history details are presented in Table 5 and figure 5a, b, c.

Table 6: Data showing the Tuning Fork tests (Air conduction, AC and Bone conduction, BC).

Tuning fork tests	Frequency	Percent
AC>BC	40	100.0

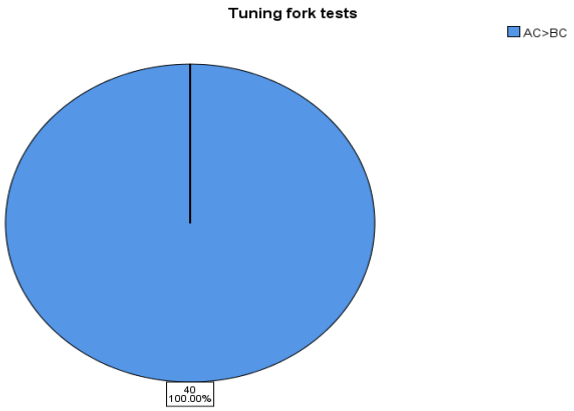

Figure 6: Data showing the Tuning Fork tests (Air conduction and Bone conduction).

In our study, all the patients had air conduction greater than bone conduction on doing tuning fork tests as shown in Table 6 and figure 6.

Table 7a: Data showing the severity of SNHL (Sensory neural hearing loss) in right ear on doing PTA in patients with tinnitus.

PTA - Right SNHL	Frequency	Percent
Normal	28	70.0
Mild	3	7.5
Moderate	5	12.5
Moderately severe	3	7.5
Profound	1	2.5
Total	40	100.0

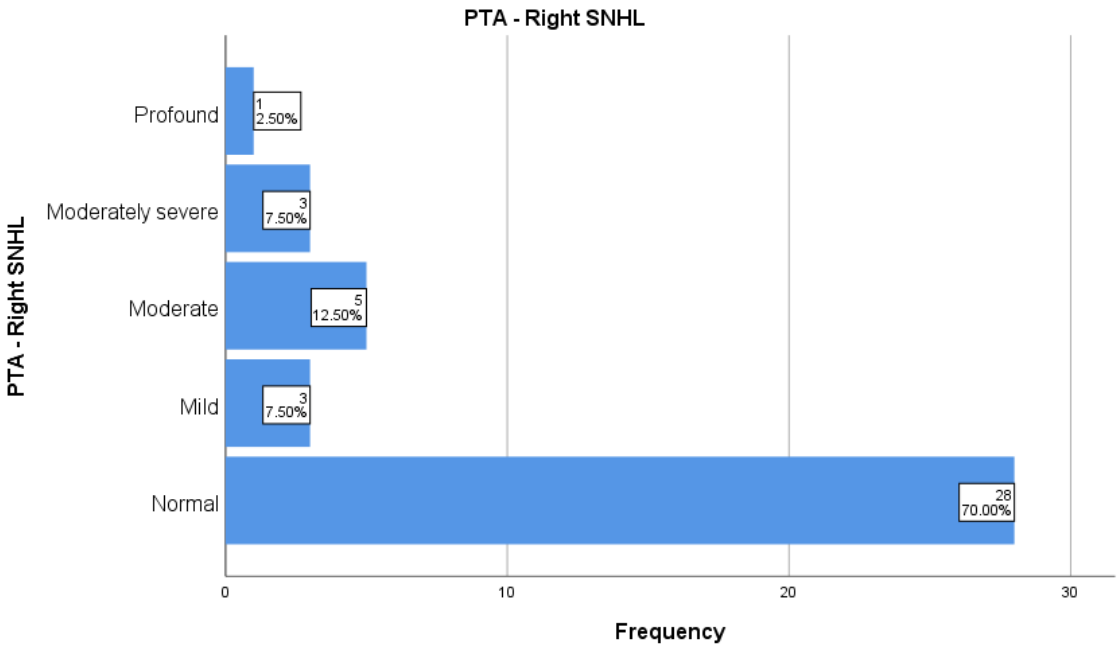

Figure 7a: Data showing the severity of SNHL in right ear on doing PTA in patients with tinnitus.

In our study, 28 out of 40 (70%) patients had normal on PTA (Pure Tone Audiometry) on right side, while 3 had mild, 5 had moderate, 3 had moderately severe and 1 had profound SNHL, as shown in Table 7a and figure 7a.

Table 7b: Data showing the severity of SNHL in left ear on doing PTA in patients with tinnitus.

PTA - Left SNHL	Frequency	Percent
Normal	28	70.0
Mild	4	10.0
Moderate	4	10.0
Moderately severe	1	2.5
Severe	1	2.5
Profound	2	5.0
Total	40	100.0

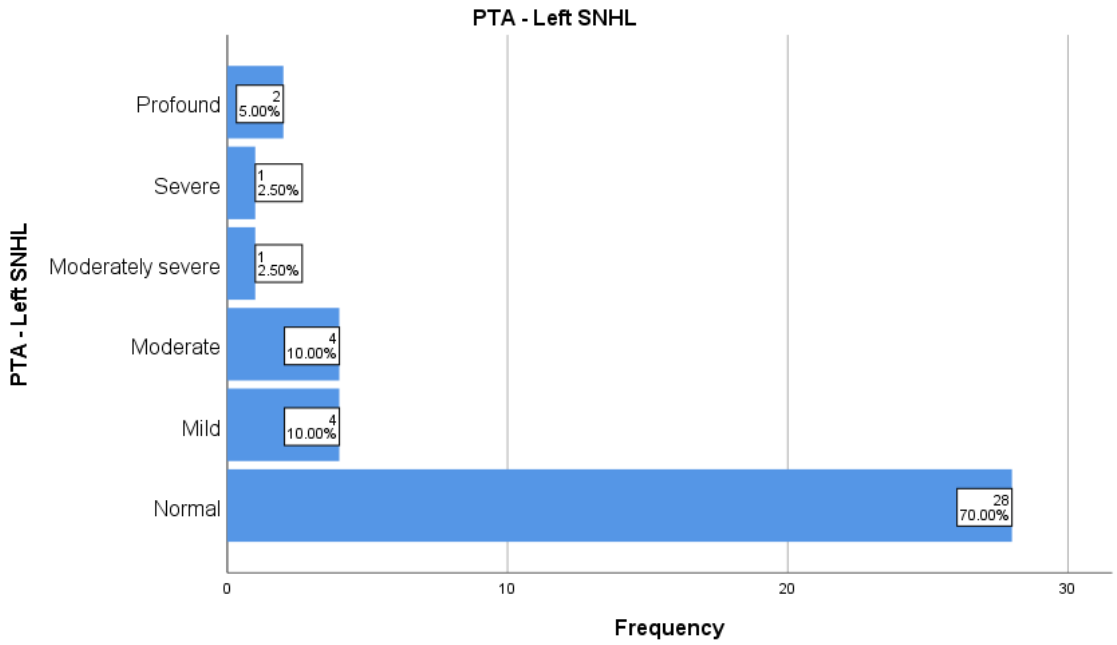

Figure 7b: Data showing the severity of SNHL in left ear on doing PTA in patients with tinnitus.

In our study, 28 out of 40 (70%) patients had normal on PTA on left side, while 4 had mild, 4 had moderate, 1 had moderately severe, 1 had severe and 2 had profound SNHL, as shown in Table 7b and figure 7b.

In our study, all the 40 patients had normal hematological investigations.

Table 8: Data showing the imaging details of patients with tinnitus.

Imaging findings	Frequency	Percent
Normal	36	90.0
AICA loop	1	2.5
IJV Diverticulum	2	5.0
Cavernous ICA aneurysm	1	2.5
Total	40	100.0

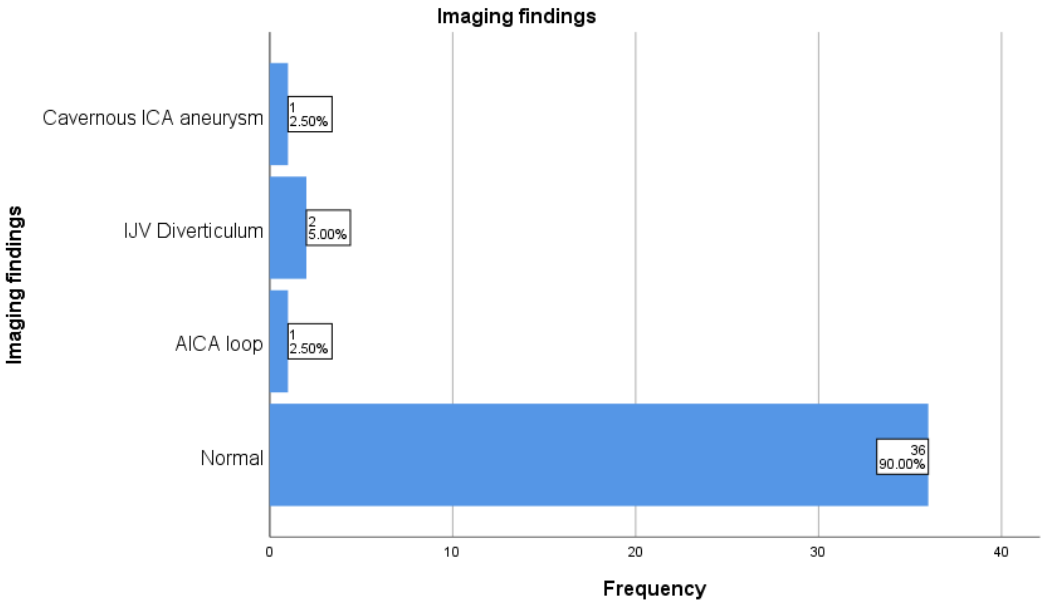

Figure 8: Data showing the imaging details of patients with tinnitus.

In our study, (Table 8 and figure 8), radio- imaging showed 4 patients with findings. One patient had type 2 AICA loop on right side and type 1 AICA loop on left side. Two patients had findings suggestive of IJV (Internal Jugular Vein) diverticulum, with one patient having wide necked postero-medially directed out pouching noted at supero-lateral aspect of on right IJV while other patient had high riding jugular bulb with supero-medial out pouching from left IJV. One patient had cavernous ICA aneurysm on right side.

Limitations

The present investigation is carried out in an academic tertiary care hospital, Mumbai in a limited period of time from Oct 2019 to Mar 2021 (18 months).

The population of the present study is a selected one attending a teaching medical institution in Mumbai which does not have the characteristics of the general population. Hence the sample may not be the representative of the general population. Recruitment of consecutive subjects ensures that there is no sample bias .The inclusion and exclusion criteria are specific. The size of the sample may be sufficient to observe the role of MRI & CT in patient suffering from tinnitus, but a larger sample size will be required to enhance the reliability and validity of the results.

CONCLUSION

Imaging is an integral component in the workup of tinnitus and may uncover the etiology behind the tinnitus. In the present study of evaluation of imaging scans of 40 patients with tinnitus, 4 patients had findings. One patient had type 1 AICA loop on left side and type 2 AICA loop on right side. Two patients had findings suggestive of IJV diverticulum. One patient had cavernous ICA aneurysm on right side. Patients presenting with tinnitus can have several neurological and vascular[11] findings as shown in this study. It is therefore, very important for referring clinicians to be aware of the significance of these findings, to inform the patient and if needed to refer for further evaluation.

REFERENCES

1. Moller AR. Introduction. In: Textbook of Tinnitus. (Ed) Moller AR, Langguth B, Riddler DD and Kleinjung T. Springer: New York, USA, 2011; 3-8.
2. Meyerhoff WL, Cooper JC. Tinnitus. In: Otolaryngology. (Ed) Paparella MM. Saunders: Philadelphia, USA, 1991; 1169–75.
3. Chari DA, Limb CJ. Tinnitus. Med Clin North Am, 2018 Nov; 102(6): 1081-1093.
4. Tang D, Li H, Chen L. Advances in Understanding, Diagnosis, and Treatment of Tinnitus. Adv Exp Med Biol, 2019; 1130:109-128.
5. Moller AR. Different forms of Tinnitus. In: Textbook of Tinnitus. (Ed) Moller AR, Langguth B, Riddler DD and Kleinjung T. Springer: New York, USA, 2011; 9-12.
6. Schleuning AJ 2nd. Management of the patient with tinnitus. Med Clin North Am, 1991; 75: 1225–37.
7. Gulya AJ. Evaluation of tinnitus. In: Primary care medicine: office evaluation and management of the adult patient. (Ed) Goroll AH, Mulley AG. Lippincott Williams & Wilkins: Philadelphia, USA, 2000; 1123–1125.
8. Weber PC, Klein AJ. Hearing loss. Med Clin North Am, 1999; 83: 125–137.
9. Moller AR. Tinnitus and Pain. In: Tinnitus: Pathophysiology and treatment, progress in brain research. (Ed) Langguth et al. Elsevier: Amsterdam, 2007; 47-53.
10. Moller AR. Similarities between chronic pain and tinnitus. Am J Otol, 1997; 18: 577-85.
11. Moller MB and Moller AR. Vascular compression syndrome of the eight nerve: Clinical correlations and surgical findings. In: Neurologic clinics: Diagnostic neurotology and otoneurology. (Ed) Arenberg IK and Smith DB. WB Sanders Publishing Co: Philadelphia, USA, 1990; 421-39.