

## CLINICAL VIGNETTE

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### Worsening Tinnitus

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A 63-year-old male presents with tinnitus. The tinnitus began about 3 months ago and was initially almost imperceptible. He noticed that the tinnitus was more noticeable when he was under significant stress, when he had poor sleep habits, or when he travelled. He described the tinnitus as high pitched and more prominent on the right side. His prior medical history includes GERD, IBS, hyperlipidemia and knee DJD. He was taking prn NSAID, but discontinuing about 2 months ago without change in tinnitus. He reports hearing difficulty for 20 years, but he has declined hearing aids. He denies otalgia, otorrhea, otorrhagia, dizziness, balance problems and recent injuries. Episodes of tinnitus usually begin with a general feeling of unease and tension, and eventually escalate. Some episodes have also been associated with a mild headache. He has previously undergone testing including head MRI and EEG, which were both normal. Current medications include pravastatin 20 mg daily, tadalafil 2.5 mg daily, metformin-SR 500 mg daily, and nightly ASA 81 mg. He reports allergy to amoxicillin with total body rash. Surgical history includes tonsillectomy at age 7 and appendectomy at age 19.

**Social History:** He denies smoking and drinks 1-2 glasses of wine about once a week.

**Family History:** Significant for early coronary artery disease and colon cancer.

Physical exam revealed a comfortable male. Vitals included Blood pressure 136/68, Pulse 58, Temperature 98.4, Height 5 feet 11 inches, Weight 172 pounds. Head and neck exam: Carotids are without bruits and JVP was normal. Conjunctivae and Sclerae were normal and Oropharynx unremarkable. Ears are normal. Head is atraumatic and normocephalic. Neck: Supple and non-tender. Lungs: Clear to auscultation and percussion. Cardiac: Regular rate and rhythm. No murmurs, rubs, or gallops. Abdomen: Soft, non-tender, non-distended with no masses or hepatosplenomegaly. Oral mucosa and conjunctiva were unremarkable. Screening neurological exam is normal.

His labs include normal CBC, chemistries, TSH, lipid panel, ESR, and urinalysis.

#### **Discussion**

Tinnitus is the continuous or intermittent perception of ringing in the ears, without an external source, which usually is

described as hissing, buzzing, or ringing.<sup>1</sup> Tinnitus is very common, with overall estimates as high as 50 million in the United States, with some having severe, disabling symptoms.<sup>1</sup> The level of the disability correlates with concomitant sleep and mood disorders including anxiety and depression, rather than the severity or type of tinnitus.<sup>2</sup> Although tinnitus is more common in the elderly, many children are also diagnosed.<sup>3</sup> Tinnitus is more common in men and symptoms can be unilateral or bilateral, continuous or intermittent, high or low frequency, and pulsatile or non-pulsatile.<sup>3</sup> Pulsatile tinnitus is more commonly associated with vascular sources and is usually louder on the side with more significant vascular disease.<sup>4</sup> Tinnitus may be associated with neurological conditions such as myoclonus especially when there is associated clicking.<sup>5</sup> Tinnitus is commonly noted in those with significant hearing loss. It is also associated with autoimmune diseases and many types of medications.<sup>3</sup> Tinnitus is often idiopathic and believed to be related to dysfunction of the deep auditory systems.<sup>6</sup> The mechanism for the generation of tinnitus has not been fully elucidated, but is believed to involve neuron disruption near the cochlea, auditory cortex, and connecting neural pathways.<sup>3</sup> Nearby vascular and musculoskeletal structures also appear to play a role in sound generation.<sup>3</sup> Some hypothesize that tinnitus may occur because of disruption of neural feedback loops creating a seizure-like disorder.<sup>3</sup>

#### **Etiology**

Tinnitus can have many potential etiologies with different pathophysiology, but presbycusis (age-related sensorineural hearing loss) appears to be the most common cause.<sup>7</sup> Other causes of hearing loss can be congenital or secondary to excessive noise exposure, medications, vascular injuries, or infections.<sup>8</sup> Medications associated with tinnitus include aspirin, NSAID's, tricyclic antidepressants, benzodiazepines, opioids, ACE inhibitors, beta blockers, antibiotics, isotretinoin, and loop diuretics.<sup>8</sup> Disorders that have been linked to tinnitus include arteriovenous shunts, arterial stenosis, paragangliomas, pseudotumor cerebri, myoclonus in the head and neck region, neuropathies, Eustacean tube dysfunction, Meniere's Disease, otosclerosis, and Chiari malformations.<sup>9</sup> Depression can also be associated with tinnitus and may be either causal or associative.<sup>10</sup>

## Diagnosis

The history and physical examination are both important when evaluating patients with tinnitus.<sup>10</sup> The history should include a complete description of the tinnitus including the quality of the sound, pulsatory vs. non-pulsatory, constant vs. intermittent, and any associated conditions.<sup>11</sup> The pitch of the sound is also important as high-pitched tinnitus is more likely to be associated with sensorineural hearing loss, while low-pitched tinnitus is more often associated with Meniere's disease.<sup>11</sup> History of trauma or significant sound exposures should be investigated along with symptoms suggesting temporomandibular joint disorders, cardiovascular diseases, neurologic illnesses, and psychiatric disorders especially mood and sleep disorders.<sup>3</sup> It is also important to assess whether symptoms correlate with time of day, body positions, or certain activities such as exercise or travel.<sup>11</sup> The patient should also be asked about family members with similar complaints, especially congenital hearing loss.<sup>12</sup> Patients should be examined carefully with a thorough neurologic, vascular, and ear examination.<sup>9</sup> Formal audiology evaluation is often indicated and further testing may include imaging of the head and neck looking for arteriovenous fistulas, arteriovenous malformations, and mass lesions.<sup>11</sup> Asymmetry in the findings may imply need to rule out an acoustic neuroma.<sup>11</sup>

## Treatment

Tinnitus can be associated with age-related hearing loss or conditions that affect the vascular or neurologic systems.<sup>4</sup> Treatment should address potential causes for the tinnitus, especially those related to vascular or neurological issues.<sup>4</sup> If a potential cause of the tinnitus cannot be identified, treatment focuses on controlling symptoms.<sup>13</sup> Tinnitus can often be chronic and troubling.<sup>11</sup> Hearing loss is a common cause or associated condition and correcting the underlying hearing loss with hearing aids or cochlear implants may be helpful.<sup>14,15</sup> Some medications can be ototoxic and contribute to tinnitus.<sup>5</sup> The damage can be permanent or reversible so discontinuing the culprit medication(s) can be important.<sup>5</sup> This is particularly common with chemotherapeutic agents or certain antibiotics.<sup>11</sup> Depression can be associated with tinnitus, however, most studies have shown anti-depressants to be ineffective for tinnitus.<sup>10</sup> Treating the associated depression may still be warranted.<sup>10</sup> Tinnitus can also be associated with sleep disorders.<sup>16</sup> Treating the sleep disorders is often important, although it rarely alleviates the tinnitus.<sup>16</sup> Various experimental treatments have been tested including cognitive behavior therapy, mindfulness modalities, biofeedback, tinnitus retraining therapy, and various types of injections.<sup>11</sup> Tinnitus retraining therapy works by allowing the patient to become habituated to the tinnitus signal leading to decreased symptom awareness.<sup>17</sup> Counselling is often combined with the tinnitus retraining therapy.<sup>17</sup> Some medications that are being studied as possible treatment options include carbamazepine, alprazolam, misoprostol, gabapentin, and lamotrigine.<sup>18</sup> Supplements that are being studied include melatonin, Ginkgo Biloba, n-acetyl cysteine, zinc, and niacin.<sup>19</sup> Acupuncture and repetitive transcranial magnetic stimulation

are also being studied and early studies are showing some promise.<sup>20</sup>

## Prognosis

The prognosis for tinnitus varies depending on the underlying cause.<sup>11</sup> The prognosis is fairly good when a reversible etiology can be found.<sup>11</sup> About 25% of tinnitus patients, though, suffer from increasing symptoms over time.<sup>1</sup> The goal of therapy in these patients is to lessen the severity of the symptoms and make them more tolerable.<sup>9</sup>

## Clinical Course and Follow-Up

This patient's hearing loss was treated with a hearing aid and daily aspirin was discontinued. The tinnitus gradually improved over six months with decreased clinical impact.

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