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Review Article

Tinnitus and the diabetic individual: a review

Manish Munjal[1], Shubham Munjal[1]*, Vineeta Arora[2], Narinder Jain[3], Swati Chauhan[1], Garima Bansal[4], Aditi Randev[4], Rubaldeep[1], Manik Kaushal[1], Sakshi Jarewal[1], Prachee Budhiraja[1], Ayush Ahuja[1]

[1]Department of ENTHNS, Dayanand Medical College, Ludhiana, Punjab, India
[2]Guru Teg Bahadur Hospital, Ludhiana, Punjab, India
[3]Department of Medicine, Dayanand Medical College, Ludhiana, Punjab, India

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***Correspondence:**
Dr. Shubham Munjal,
E-mail: manishmunjaldr@yahoo.com

ABSTRACT

Tinnitus infact is a sound that is heard inside the head and not having an external source of origin. It is an unwelcome sensation that irritates continuously and dubious modalities have been advocated for its management. In the diabetic there is a multi-system involvement, with a major brunt, on the neural pathways and receptors. In the audiological region, a vital component of the nervous system, there is a high likelihood of onset of tinnitus, in subjects with underlying type 2 diabetes mellitus (T2DM).

Keywords: Tinnitus, Diabetes mellitus type II, HB1AC neuropathy

INTRODUCTION

Tinnitus is a malady of the human audiological system that markedly affects and deteriorates one's "quality of life". Unusual sound in one or both ears without an extrinsic source is aptly termed as tinnitus. Onset of tinnitus may be spontaneous minus a clear aetiology but often has an association with a local aural pathology or systemic ailments like hypertension and diabetes. Persistent tinnitus though not categorized a chronic disease, effects the quality of life by causing disturbance in daily concentration and the sleep cycle.[1] Tinnitus is one of the problems related to the hearing system which degrades the quality of life. Tinnitus refers to abnormal hearing sounds in one or both ears in the presence of no external source of sound. 43% of diabetic individuals were documented to have the irritating symptom of tinnitus in South Korean research. The neurological side effects of diabetes mellitus led to impairment of the audio-vestibular pathways. The Sasso et al study compared the normal and the diabetic population and recorded Otoacoustic emissions with lower amplitude. The impairment was related to the duration of presence of type 2 diabetes mellitus.[2]

Roy et al documented that diabetic mellitus involves both the vestibular and cochlear functions.[3] Likelihood of diabetic vestibulopathy is increased with the presence of diabetes-related hearing impairment. The diabetic individuals manifest with an impaired vestibular input as the microcirculation that maintains cochlear function even involves the circulation of the vestibular receptors.[3] Diabetes mellitus is a metabolic disease where there is hyperglycemia in the body and that maybe due to three factors: reduced insulin secretion, reduced action of insulin or both combined.[4] The morbidity and mortality in diabetics is consequent to vascular complications that may arise due to interactions between systemic metabolic abnormalities like hyperglycemia, dyslipidemia, genetic and epigenetic modulators, and local tissue responses to

toxic metabolites.[5] Late common untoward sequels of diabetes mellitus include retinopathy, nephropathy, neuropathy, sexual and cardiac dysfunction.[6] The last three decades has seen, twice the number of diabetic patients in the global population thus making us aware about the severity and the challenging issues of this ailment, for all healthcare systems.[7] Age, obesity, sedentary life style, gestation, diabetic family history, are the risk factors for diabetes.[8]

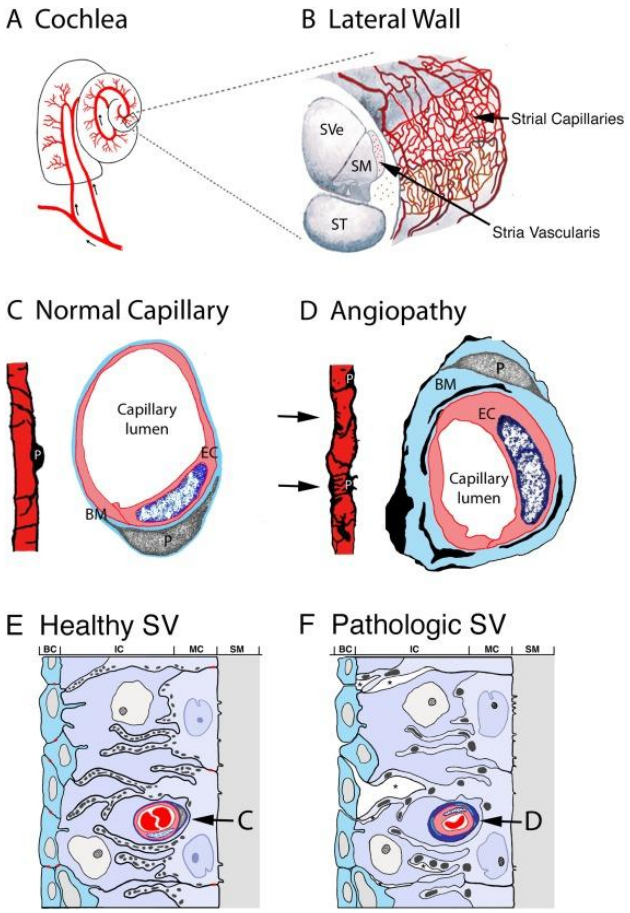

Figure 1: A pathologic capillary with a thickened wall of endothelial and basement membrane reduces the lumen which is further constricted by the pericytes (arrows); the oxygen and nutrient delivery is further decreased with consequent reduction to a of the endocochlear potential and thereby inner ear sensitivity.[19-22]

Diabetes mellitus is diagnosed on the basis of HbA1c levels that indicate the average glucose level of the last two to three months in the individual's blood. The level is directly proportional to symptoms of diabetes related to narrow and to some extent, wide diameter blood vessels.[9] Hb A1C level is a vital parameter that dictates care of the diabetic individual. Therefore, HbA1c level measurement has been introduced as a relevant investigation for endocrinologists and health care personnel.[10] One of the most important symptoms of diabetes mellitus is its impact on the nervous system by enhancing apoptosis through oxidative destruction.[11,12]

The neuronal cells are damaged by hyperglycemia. The hyperglycemia impairs vasodilatation and thickens the basement membrane of the capillaries by endothelial hyperplasia (Figure 1). This further reduces the oxygen tension. Moreover, hyperglycemia decreases the Na+K+ATPase activity, required for maintenance of baseline normal nerve resting membrane potential as well as providing neurotrophic support.[5]

DISCUSSION

The degenerative processes in the ageing human nervous system are likely to affect the onset, intensity and duration of tinnitus. The latter are affected by a co-existing diabetes mellitus. Analysis thereby becomes complex and so do the results.

An association between tinnitus and diabetes in individuals above 60, thus still needs confirmation.[17] The Somogy et al study documented that the diabetic individual had a strong preponderance towards developing an intrinsic tinnitus, vis a vis healthy controls in the same age bracket.[18] 19–65% of diabetic individuals have been observed to have disturbing tinnitus in global literature.[13,15] There is a meaningful dependency between patients' age and severity of tinnitus. That is in those with mild tinnitus symptoms, the probability of suffering from tinnitus increases with age. This dependency has also been recorded in subjects with markedly severe tinnitus.

Kim et al analysis, exhibited a dependency between age and severity of tinnitus.[16] With onset and progression of diabetes, the probability of suffering from neuropathy and worsened auditory perception due to neuro-sensory deterioration increases with age, which would affect the outcome of any research undertaken. Increase in the time period of diabetes with age and some other system involvements with their symptomatology too effects the interpretations. Thus, an obvious correlation between tinnitus and diabetes in subjects over 60 has not been confirmed.[17] Dependency between age and tinnitus can be due to the duration of diabetes mellitus as the longer the diabetes mellitus duration, the more severe the side effects of the disease.

Somogy et al showed an association between tinnitus and diabetes, with people suffering from diabetes mellitus being more likely to have tinnitus than healthy people of the same age.[18]

CONCLUSION

Existence of an inter-relation is noted between biological age and diabetic status and the severity of tinnitus. Duration of presence of diabetes too enhances the susceptibility of acquiring tinnitus. In the diabetic, tinnitus can be taken as a marker of developing neuropathy or degree of cochlear microangiopathy.

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