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SIGNIFICANCE OF MALONDIALDEHYDE (MDA) IN DIABETIC COCHLEOPATHY

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ABSTRACT

Cochleopathy is one of the morbid complication of diabetes mellitus (DM) leading to irreversible sensori-neural hearing loss. The aim of the study is to study the significance of MDA in diabetic cochleopathy. This is a cross sectional study which includes hundred diabetic patients attending tertiary health care center. Serum MDA levels were assayed by TBARS method (Thiobarbituric acid Reactive substances) , HbA_{1c} by Ion-exchange chromatography & hearing by Pure-tone audiometry. Out of 100 diabetic patients, 87 had MDA level > 2 µmol/L, & out of 87 diabetic patients with MDA levels >2 µmol/L, 45 had hearing loss which is significant. From the results obtained, we find that the hearing impairment in diabetic patients is influenzed by the oxidative stress. So screening of the diabetic patients by estimating serum MDA levels & bone conduction by pure tone audiogram is advised so as to prevent the occurrence of diabetic cochleopathy & also the worsening of the disease complication.

KEYWORDS: **Cochleopathy, Pure-tone audiometry, Diabetes mellitus, Malondialdehyde, oxidative stress.**

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INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder. It occurs mainly due to decreased insulin secretion, its action, or both which causes disturbances of carbohydrate, fat and protein metabolism. If not diagnosed or treated properly there will be progression of the disease leading to tissue or vascular damage resulting in complications such as retinopathy, cochleopathy, neuropathy, nephropathy, cardiovascular complications and ulceration. Cochleopathy leading to irreversible sensori-neural hearing loss, results in increased morbidity in diabetes mellitus[1,2]. Free radicals produced due to persistant hyperglycemia in diabetes mellitus damage lipids, proteins and nucleic acids leading to cochleopathy[3,4,5]. The pathogenesis of free radical induced complications include advanced glycated end products, polyol pathway flux, increased expression of the receptor for AGEs, overactivity of the hexosamine pathway & activation of protein kinase C isoforms. The pathogenesis of oxidative stress induced diabetic cochleopathy include the microangiopathy of the inner ear. neuropathy of the cochlear nerve, outer hair cell dysfunction, & disruption of endolymphatic potential[6,7]. So this study was done to estimate MDA levels in serum in diabetics, an end product of lipid peroxidation which can be used as an oxidative stress marker & relating oxidative stress with diabetic cochleopathy.

MATERIALS & METHODS

A sample of 100 type-2 diabetic patients in the age group of 35–55 years were included in this study. The study was done in diabetic department of a tertiary care hospital. The study was done after getting the approval from the institutional ethical committee. Patients with ear, nose & throat infection; high blood pressure; history of consumption of ototoxic drugs; previous history of ear surgeries; sensori-neural hearing loss of various etiology (as shown by pure tone audiogram at 4000Hertz); and positive family history were excluded from this study. Informed consent was obtained from the patients. Serum was taken for the estimation of glucose, MDA and whole blood for HbA_{1c} by venepuncture, under aseptic precautions, so as to avoid hemolysis. Ion Exchange Chromatography was the method used to estimate $HbA_{1C,}$ the TBARS method for malondialdehyde estimation & Pure Tone Audiometry for cochlear function. MDA levels were compared with bone conduction Pure Tone average.

RESULTS

Table 1
MDA Status in Diabetic subjects

Subjects/Sex	MDA upto 2 µmol/L	MDA > 2 µmol/L	Total
Male	6	38	44
Female	7	49	56
Total	13	87	100

Table 2
Hearing status in diabetic subjects

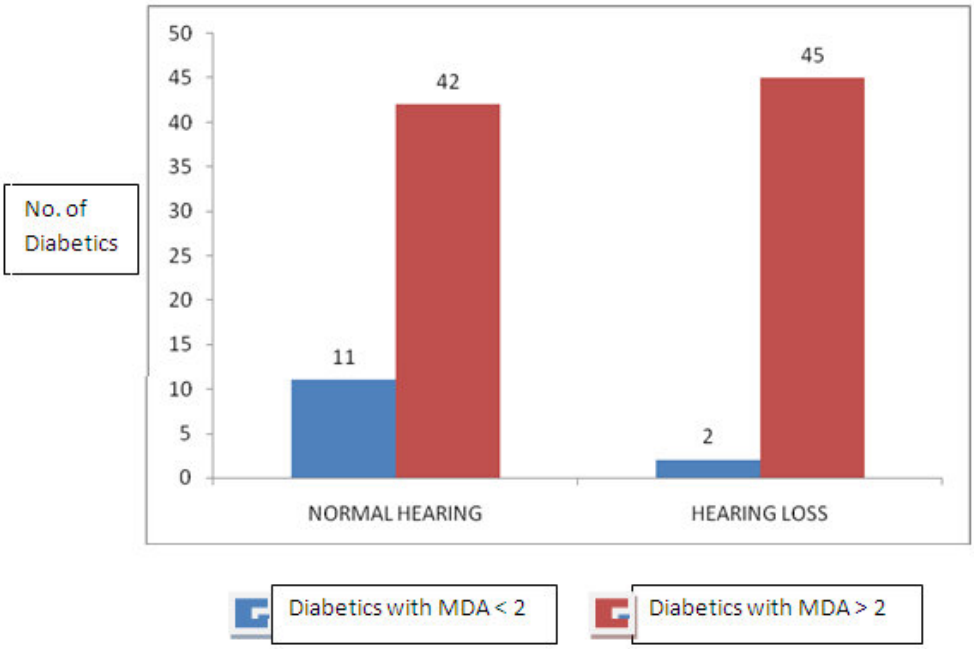
Subjects/Sex	Normal Hearing	Hearing loss	Total
Male	21	23	44
Female	32	24	56
Total	53	47	100

Table 3
Comparing MDA levels with Hearing in diabetic subjects

MDA Levels	Bone Conduction Pure Tone average		Total	Chi-square Value	p-value
	Normal hearing	Hearing loss			
Upto 2 µmol/L	11	2	13	5.998	0.013 Significant
>2 µmol/L	42	45	87		

Out of 100, 87 diabetic patients with MDA level >2 µmol/L & out of 87, 45 had hearing loss which is significant.

Figure
Comparing MDA with hearing in diabetic population



DISCUSSION

This cross sectional study was done in a tertiary care center with 100 diabetic patients taken randomly of age group 35 – 55 years. Age group >55 years were not included in this study so as not to be confused with sensori-neural hearing loss which is more common in the age group >55 called as presbyacusis. This statement was approved in the study done by Kurien et al[8]. In his study he selected the diabetic patients of age group 20 – 45 years to estimate hearing threshold by pure tone audiometry, but there was a controversial statement in the study given by Kakarlapudi[1] and Dalton[9] . There was no significant sexual difference in having predominant hearing loss. Many studies proved the positivity of occurrence

of irreversible & sudden hearing loss in diabetics as shown in our study[1,2,8,9]. This study adds to our knowledge about the pathogenesis of hearing loss in diabetics which was unclear in the previous studies. Kurien[8] and Lasisi[2] found that the cause is due to the damage produced by the glycated end products gets deposited in the inner ear. Finally from this study it was proved that one of the cause of diabetic cochleopathy may be due to oxidative stress induced by free radicals produced by the progression of disease. This free radical induced lipid peroxidation should be estimated by MDA in the serum as shown in this study being MDA is the end product of lipid peroxidation[10,11]. The similar study was done by Aladag I et al. & Slatter DA et al[5,11]. Slatter DA et al . told in his study that Malondialdehyde (MDA) is a by-product formed by lipid peroxidation from free radicals and is highly toxic. MDA cause complication in diabetes mellitus by reacting with proteins and phospholipids both irreversibly and reversibly. In this study diabetics with hearing loss had increased MDA levels compared to uncomplicated diabetics. This is supported by the study done earlier by John W Baynes ey al[3].

CONCLUSION

This study pointed out that the MDA levels is one of the oxidative stress marker & important diagnostic tool in diabetic cochleopathy. In this study, 51.7% of diabetics had hearing loss got MDA levels >2 µmol/L which is significant compared to 15.4% of diabetic cochleopathy patients had MDA levels upto 2 µmol/L. This, study shows that diabetics with MDA levels greater than 2 had high risk to get cochleopathy. So it is highly recommended to screen the diabetic patients by estimating serum MDA levels & bone conduction by pure tone audiogram to prevent the occurrence of diabetic cochleopathy & its progression.

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