

**AUDIOLOGICAL EVALUATION OF PATIENTS WITH DILATED
CARDIOMYOPATHY****Ibrahim Hassan Abdelhamid***

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ABSTRACT

A decrease in the blood supply to the cochlea as a result of cardiovascular disease may result in cochlear degeneration and will disrupt the physical and chemical processes in the cochlea. This, in turn, may lead to hearing impairment. So this study was designed to evaluate auditory disorders in patients with dilated cardiomyopathy and to correlate the degree and configuration of hearing loss with the degree and duration of dilated cardiomyopathy. This study was carried out on 20 subjects 10 control subjects and 10 with dilated cardiomyopathy. Full history, clinical examination and audiological evaluation including basic tests and DPOAE and neuro otological ABR was done. Eighty percent of 10 patients with DCM had bilateral SNHL ranged from mild to moderately severe; affecting all frequencies to the greatest degree at high frequencies and 20% (2 patients) had bilateral normal hearing sensitivity. DPOAE were present in all cases of control group and 2 cases with normal hearing from the study group, the remaining cases of study group partially pass indicating impaired cochlear function in study group. Results of (ABR) measurement showed that normal absolute and inter peak latencies in control and study groups. The duration of the disease, have no effect on degree of hearing loss, absolute and inter peak latencies of ABR.

KEYWORDS: Cardiomyopathy, hearing loss dilated cardiomyopathy.**INTRODUCTION**

The heart performs the crucial function of providing a supply of blood to all the parts of the body. Therefore, any dysfunction or abnormality of the heart is likely to affect the entire body.^[1] These effects include fatigue, reduced mobility in the limbs, and some degree of failure in the functioning of major organs, such as the liver and lungs. There also is evidence of some degree of disruption in the functioning of other organs, such as the auditory system.^[2] The cochlea is situated in the inner ear and convert sound vibrations into action potentials that are transmitted to the auditory cortex for interpretation.^[3] The cochlea is supplied by the labyrinthine artery, which arises from the meatal loop of the middle cerebral artery or a branch from the basilar artery, which penetrates into the internal acoustic meatus.^[4] Both spiral and radial arteries are present within the cochlea.^[5] The stria vascularis arteries in the cochlea have a large capillary blood flow. A decrease in the blood supply to the cochlea as a result of cardiovascular disease may result in cochlear degeneration and will disrupt the physical and chemical processes in the cochlea.^[6] This, in turn, may lead to hearing impairment.^[7] Hearing loss as a result of cochlear hypoxia was confirmed in study conducted by.^[8] This finding was supported by other studies that reported the absence or significantly reduced distortion product otoacoustic emissions following an ischemic injury to the cochlea.^[9-10] Diseases of the myocardium

associated with cardiac dysfunction are referred to as cardiomyopathies. Dilated cardiomyopathy (DCM) is defined as left ventricular (LV) dilation and systolic dysfunction in the absence of coronary artery disease or abnormal loading conditions proportionate to the degree of LV impairment.^[11] One of the leading causes of heart failure (HF), DCM predominantly affects younger adults and is the most frequent indication for cardiac transplantation. The condition is best regarded not as a single disease entity, but rather as a nonspecific phenotype, the final common response of myocardium to a number of genetic and environmental insults.^[11]

Several studies have indicated that 25 to 30% of DCM is familial.^[12] DCM and sensorineural hearing loss (SNHL) are prevalent disorders that can occur alone or as components of complex, multi-system syndromes. However, there has been no prior identification of any isolated co-inheritance of these phenotypes.^[13] Similarly, incidents of hereditary sensorineural hearing loss have a significant degree of non-allelic and allelic genetic heterogeneity, which can be dominant, recessive, X-linked, or mitochondrial. Therefore, it is important to determine the hearing loss of patients with dilated cardiomyopathy.

Aim of the work

- 1) To evaluate hearing of patients with dilated cardiomyopathies.
- 2) To correlate the degree of hearing loss with the degree and duration of dilated cardiomyopathy.

MATERIAL AND METHODS

The subjects in this study divided into two groups. Group 1 was the control group this group consists of 10 normal persons they were selected from relatives of audiological patients. Group 2 was the study group, 10 patients with dilated cardiomyopathy (DCM) with age range from (18–57 years) were referred from the Cardiology Clinic to the Audiology Unit at Al Hussein Hospital Al- Azhar University.

Selection criteria of control group

The controls were chosen according to the following criteria: matching for age and gender distribution with those for the study group; no history of ear problems, hearing loss, or cardiac problems.

Selection criteria of study group

All patients were chosen according to the tenets of the European Society of Cardiology. DCM was defined by left ventricular (LV) ejection fraction <45% or fractional shortening <25% diagnosed by echo cardiogram, and LV end diastolic diameter >117% of the predicted value corrected for age and body surface area.

Equipment

The equipment used in this study included two-channel diagnostic audiometer (Interacoustics, model AC40), Immittance meter (Interacoustics, model AZ26), Otoacoustic Emission Analyzer Madsen model (Celesta 503), evoked potential audiometer model (Nicolet Compact four), and sound-treated room (locally made) according to the international specifications of sound-treated rooms.

Methodology

The subjects of this study were submitted to the following.

History, Medical examination, and Laboratory investigation

Full histories were taken for all the subjects with emphasis on hearing problems, cardiac manifestations

and duration of the disease. The laboratory investigation included complete blood count (CBC), renal function tests, and liver function test.

Basic Audiological evaluation:**a- Pure tone audiometry**

Air conduction hearing threshold level for octave frequencies between 250-8000 Hz and bone conduction threshold for frequencies between 500-4000 Hz were done.

b- Speech audiometry

Speech Reception Threshold (SRT) using Arabic spondee words.^[14]

Word discrimination scores (WDS) using Arabic phonetically balanced words.^[15]

C- Immittanceometry

Tympanometry and acoustic reflexes was done to evaluate the middle ear.

**Distortion product otoacoustic emission (DPOAE).
Neuro-otologic auditory brainstem response (ABR).****Statistical analysis**

Qualitative data were presented as frequencies (n) and percentages (%). Chi-square test was used for comparisons between the two groups.

The significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM® SPSS® Statistics Version 20.

RESULT

This study was carried out on 2 groups: control group 10 persons 6 females and 4 males their age ranged from 17 to 58 years with the mean of 43.5 while the study group included 10 patients with dilated cardiomyopathy 6 males and 4 females. The age ranged from 18-57 years with the mean of 41.5. There was no statistically significant difference between both groups according to age and gender distributions.

Both ears of all subjects were evaluated, so the total number of ears was 20 for control group and 20 for study group. Basic audiological evaluation was done for all subjects included in this study, and revealed that.

Table (1): Mean and SD of pure tone threshold of both groups.

Groups	250	500	1000	2000	4000	800
Group 1	15.75±4.4	14.75±4.5	15.25±5.2	14.75±4.3	13.75±4.2	15.25±3.9
Group 2	29.25±6.1	30.25±6.3	30.75±6.8	30.5±8.5	42.5±11.2	50.25±15.7
P value	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

There is highly statistically significant difference between both groups.

Table (2): Speech Reception Threshold (SRT) and Word Discrimination (WD) scores in both groups.

Groups	SRT	WDS
Group 1	15.25±4.2	96.8%±3.2
Group 2	30.5±7.5	91.2%±4.9
P value	0.0001	0.12

There is statistically significant difference between both groups according to SRT and no statistically significant difference between both groups according to WDS.

Tympanogram and acoustic reflex results

All cases in the two groups had type A tympanogram. No statistical comparison could be computed because all cases fell into one category and acoustic reflexes preserved in all persons of control group but elevated in all patients of study group.

DPOAE were present in all cases of control group and 2 cases with normal hearing from the study group, the remaining cases of study group partially pass indicating impaired cochlear function in study group.

Table (3): Result of DPOAE.

Groups	Pass	Partially pass
Group 1	100%	0%
Group 2	20%	80%

Table (4): Mean and SD of absolute and inter peak latencies of both groups.

Groups	I	III	V	I-III	III-V	I-V	V'
Group 1	1.58±0.02	3.72±0.02	5.62±0.021	2.13±0.029	1.9±0.021	4.04±0.026	5.85±0.016
Group 2	1.64±0.06	3.75±0.05	5.72±0.047	2.1±0.048	1.97±0.045	4.08±0.039	5.98±0.05
P value	0.21	0.3	0.031	0.33	0.08	0.17	0.011

No statistical significant difference was found between cases and controls

DISCUSSION

The heart is a pump. Through coordinated contraction of the atria, blood is pumped into the ventricles. The ventricles, which do most of the work of the heart, contract synchronously to pump blood to the rest of the body. The left ventricle, the most forceful chamber of the heart, pumps blood to the rest of the organs, including the brain and other vital organs. The brain is particularly sensitive to blood pressure and flow.^[16] If the mechanical activity of the heart is impaired, it effect the blood flow to brain and cochlea and may be cause sensorineural hearing loss. The main hallmark of primary dilated cardiomyopathy (DCM) is the presence of a left or biventricular dilatation with severely impaired systolic function in the absence of abnormal loading conditions (i.e., hypertension, valve disease, etc.) or ischemic heart disease sufficient to cause global systolic impairment.^[17]

The present study was designed to evaluate the hearing in patient with dilated cardiomyopathy. 20 subjects participated in this study with the age range 17-58 years. The control group 10 persons with bilateral within normal peripheral hearing and the study group consisted of 10 patients with dilated cardiomyopathy.

Basic audiological evaluation remain the keystone of the audiological diagnosis to define the degree, type and the configuration of the hearing loss.^[18] The configuration of the audiogram may give a clue about the cause of SNHL.^[19]

Eighty percent of 10 patients with DCM had bilateral SNHL ranged from mild to moderately severe, affecting

all frequencies to the greatest degree at high frequencies. Twenty percent (2 patients) had normal hearing sensitivity (table 1). Word recognition scores are within expected ranges for the degree of hearing loss.

Schonberger et al. (2000) reported two families with many members affected by sensorineural hearing loss, which occurred mostly in early adulthood and preceded the appearance of dilated cardiomyopathy (DCM), which usually occurred in the fourth decade.^[20] DCM and SNHL was found to be inherited as autosomal dominant and linked to chromosome 6q23 to 24.

All cases have bilateral type A tympanograms and preserved acoustic reflexes but elevated in study group reflecting normal middle ear pressure.

In addition, there is no statistically significant difference between both groups according to word discrimination scores (table 2).

In this study, DPOAEs was done as frequency specific, fast, objective and non-invasive audiological procedure to study the cochlear function. In individuals with sensorineural hearing loss, distortion product otoacoustic emissions are often eliminated only for the stimulus frequency regions which coincide with the impaired region.^[21-22]

DPOAE were present in all cases of control group and 2 cases with normal hearing from the study group, the remaining cases of study group partially pass indicating impaired cochlear function in study group (table 3).

In the current study, results of (ABR) measurement showed that normal absolute and inter peak latencies in control and study groups. No statistical significant difference was found between controls and study group indicated hearing loss in study group is cochlear hearing loss (table 4).

No correlation between the duration of the disease and the degree of hearing loss. The correlation coefficient value 0.12 ($R < 0.5$) is very weak also no correlation between the duration of the disease and absolute and inter peak latencies of ABR waves. This disagree with study of *Solkani. (2012)* who found that the duration of cardiovascular disease significantly influenced all air conduction thresholds.^[23]

SUMMARY

Hearing disorders were observed in patient with dilated cardiomyopathy. So this study was designed to explore the nature of auditory disorders in patients with dilated cardiomyopathy and to correlate the degree and configuration of hearing loss with the degree and duration of dilated cardiomyopathy so evaluate patients with hearing loss for early intervention.

This study was carried out on 20 subjects 10 control subjects and 10 with dilated cardiomyopathy were referred from cardiology clinic with full investigation and diagnosis. Full history, clinical examination and audiological evaluation including basic tests and DPOAE and neuro otological ABR was done.

All subjects with cardiomyopathy were evaluated for both ears. So the total number of ears were 20 ears.

Eighty percent of 10 patients with DCM had bilateral SNHL ranged from mild to moderately severe; affecting all frequencies to the greatest degree at high frequencies and 20% (2 patients) had bilateral normal hearing sensitivity. All cases have bilateral type A tympanogram reflecting normal middle ear pressure.

DPOAE were present in all cases of control group and 2 cases with normal hearing from the study group, the remaining cases of study group partially pass indicating impaired cochlear function in study group.

Results of (ABR) measurement showed that normal absolute and inter peak latencies in control and study groups.

The duration of the disease, have no effect on degree of hearing loss and absolute and inter peak latencies of ABR.

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