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RESEARCH ARTICLE

METABOLIC DISORDERS AN INCREASED RISK FOR AUDIOLOGIST AND INVESTIGATION

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ABSTRACT

Metabolic disorder is a flashing issue in aging group. The controlled medication helps the population to lead life easily but the same way increases a factor as high risk to auditory sensory impairment
Aim: To evaluate the impact of metabolic impairment on hearing status.
Objective

- To find the auditory findings in the metabolic disorders.
- To estimate the role of audiologist in the metabolic disorders.

Methodology: The subjects with metabolic disorders as diabetic, Febry, Auto immune disease and rheumatoid arthritis were taken for this study and undergone the audological evaluation for the estimation of the hearing threshold. The audiological test battery includes the conventional frequency audiometry, immittance audiometry, otoacoustic emissions.
Results: Results show that the audiologial evaluation of the metabolic disorders subjects may have various hearing disorders as Progressive hg loss, sudden sensorineural hearing loss, fluctuating hearing loss, idiopathic sudden senseorineural hearing loss.

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INTRODUCTION

Metabolic disease is dysfunction caused by defect in the hormonal or chemical reaction of the body cell. Metabolic disorders include digestive diseases, Nutrition and Obesity, Kidney, Urologic and hematologic diseases. All metabolic disorder may not show hearing problem but certain diseases results in predominant hearing loss. One of the metabolic disorders that results in hearing loss is Diabetes, Fabry disease, Arthritis, Renal failure, autoimmune diseases. Diabetes is a metabolic disorder resulting from poor or no insulin secretion by the pancreas. Hearing loss is about twice common in diabetics. Idiopathic sudden hearing loss tend to increase as the number of cardiovascular risk factors increases. Mild or greater hearing impairment of low or mid frequency sounds in the worse ear was about 21% in 399 adults with diabetes compared to 9 in 4741 adults without diabetes. Patients with rheumatoid arthritis also have hearing loss. It has been found that Hearing loss in arthritis occurred at younger age. Subjects suffering from arthritis and hearing loss were 41 years old on average in comparison with an average age of people in the healthy population with hearing loss of 52 yrs.

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Women were more affected than men. 71% of females with arthritis suffered from hearing loss in comparison to 41% of the women the control group. Fabry diseases are an x linked in born error of glycol sphingolipid metabolism due to the deficient activity of alpha galactosidase A, a Lysosomal enzyme. A total of 12 patients with classic fabry diseases were found to have abnormal audition. Five patients had progressive hearing loss and seven patients experienced sudden Deafness.
Patients with autoimmune disease show autoimmune hearing loss which is a sensorineural. Hearing loss. It occurs typically in adults between the ages of 20 and 50yrs females are affected more often than men and patients may have another autoimmune disorder or have a prior. Diagnosis of Meniere's syndrome in nearly 80 percent of cases, both ears are affected, it has been reported from different studies that metabolic disorder contribute much pathophysiological changes in whole body system .To regulate the impaired metabolism several medications are used. It's now a dilemma that side effects issues with impaired metabolism is due to impaired composition /medicational effects, Several studies has shown that metabolic disordered population has predominant features of decrease in HG threshold. Compiling various studies, the various types of Hearing status has been documented as

- Sudden Hearing Loss
- Idiopathic Sudden sensory Neural Hearing loss

- Progressive Hearing Loss
- Fluctuating Hearing Loss
- Mixed Hearing Loss
- Although The Degree Of Hearing Loss Depends On The Duration Of Medications Used.

This study aims at profiling the hearing thresholds of various metabolic disorders as FABRY, DIABETIC, FABRY DISEASE, and AUTOIMMUNE DISEASE. As reported by Dominique P German, Paul Avan, Augustin Chasssing and Pierre Bonfils in 2002 found that the incidence of hearing loss appeared significantly increased in Fabry disease patients. According to the study 54.4percent found to have abnormal audition .32percent experienced sudden deafness and 27 percent had progressive hearing loss. According to Mc Cabe 1979 and other researchers found that 80 percent of the subjects with autoimmune disease show bilateral hearing loss,50 percent are found to have vestibula dysfunction including disequilibrium, ataxia and motion intolerance .Diabetic Cardiovascular Risk Factors and Idiopathic sudden sensorineural hearing loss: A case study–C Aimoni, C. Bianchini, M. Borin, A Ciorba, R. Fellin, A. Martini, G. Scanelli, S. Volpato 2009 reported that 5.6 percent of the subjects with diabetics were found to have Idiopathic sudden sensorineural hearing loss . The prevalence of hearing loss among rheumatoid arthritis patients is higher than among the normal healthy population, according to Spanish study. The study carried out by the University Hospital Clinici in Valencia, Spain October 2008 found that 71percent of females with arthritis suffered from hearing loss. In the current era there is an increased metabolic disorder in the population due to the many reasons including the life style, diet, hereditary and idiopathic factors. The medications used for the metabolic disorders is resulting in the associated side effects of which one is hearing loss This is increasing the role of the audiologist in the awareness and planning the rehabilitation of the person with metabolic disorders.

Aim of the Study

- This study is aimed to profile the hearing loss in the different types of metabolic disorders.

Need of This Study

- This study helps the audiologist to explore the effects of metabolic disorders and helps in management process.
- This study helps the audiologist to create awareness among the people about the positive effects of metabolic disorders on audition in active and passive smokers.

METHODOLOGY

A total of 20 subjects were selected with metabolic disorders following medications in the control group with minimum consumption of medications for at least 6 months .All the subjects selected for the study were in the age group of 40-60 yrs of both sexes .Preliminary case history was taken to know the auditory status and family history of metabolic disorders and hearing loss. The inclusion criteria of the study for the metabolic disorder subjects includes

- The subjects should not have the family history of hearing loss.
- The subjects should not have the family history of metabolic disorders.
- The subjects should not have any other congenital anomalies of the auditory system.
- Duration of usage of medications must be at least for 6 months.

The subjects were divided into 4 groups based on the type of metabolic disorder.

- **Group 1:** The first group of subjects included 5 with Diabetes in the age range of 40-60yrs.
- **Group 2:** The second group of subjects included 5 with Fabry disease in the age range of 40-60yrs
- **Group 3:** The third group of subjects included 5 with autoimmune disease in the age range of 40-60yrs.
- **Group 4:** The fourth group of subjects included 5 with rheumatoid arthritis in the age range of 40-60yrs.

Subject Categories	Number (N)	Mean age (years)	Age range
Diabetics	5	49.5	40 -60 years
Fabry Disease	5	49.5	40 -60years
Autoimmune Disease	5	49.5	40-60years
Rheumatoid arthritis	5	49.5	40-60years

Instrumentation

Audiological test battery was administered on the selected population. Pure tone audiometry was done to obtain the hearing threshold using ALPS AD2100 audiometer and earphone TDH39P,BCb72 for both right and left ears in accordance with ASHA Guidelines and ANSI(1996) specifications after Providing adequate instructions for 2-3 trials with check re-check reliability for both AC(250Hz-8KHz) in the octave frequency range and then the same procedure was followed for 250Hz-4KHz estimating the BC threshold by using bone vibrator BCb72.Speech audiometry for SRT &SDS to correlate PTA results using the same audiometer using Spondee & PB words in Telugu. The subjects undergone for Immittance testing using MAICO-MA52 immittance audiometer to explore middle ear dysfunction by instructing the participants. Not to swallow & hold the breath during testing. Otoacoustic emission testing was also done using acoustic screener model no. Bilogic Adeax. The test results for all the groups i.e diabetic, Febry, Auto immune disease and rheumatoid arthritis are recorded and subjected to statistical analysis to find out the effect of metabolic disorders on hearing status and which metabolic disorder has a greater impact on auditory sensation.

RESULTS

The audiological test battery was administered separately on the different types of metabolic disorders which include subjects of diabetics, arthritis, autoimmune disease and fabry disease. Pure tone Audiometry, Speech Audiometry, Otoacoustic and immittance testing showed variations in the threshold of the subjects with high frequency flat audiogram. Otoacoustic examination showed cone of light with normal tympanic membrane for diabetic and autoimmune disease population and some conductive component in the rheumatoid arthritis and fabry‘s disease population. Pure tone audiometry was done on the selected subjects using the audiometer ALPS AD 2100 with ANSI Specifications.

Metabolic Disorder	Duration of Medication	No. of Subjects	PTA	Speech Audiometry		Tympano metry	Reflexometry	OAE
			Bilateral	SRT	SDS	Bilateral		.
a	6 Months	1	45dB	50 dB	90%	Atype	Elevated	Absent
b	1year	1	60dB	70 dB	80%	Atype	Absent	Absent
Diabetics	7 months	1	50dB	55 dB	90%	Atype	Elevated	Absent
c	15 months	1	80dB	90 dB	60%	Atype	Absent	Absent
d	2years	1	95dB	100 dB	40%	Atype	Absent	Absent
e								
a	8 months	1	50dB	55 dB	85%	Astype	Elevated	Absent
b	12 months	1	40 dB	50dB	90%	Atype	Elevated	Absent
c								
Rheumatoid d	6months	1	40 dB	55dB	85%	Atype	Elevated	Absent
Arthritis e	16 months	1	70dB	80dB	65%	Adtype	Absent	Absent
	2years	1	85dB	95dB	50%	Adtype	Absent	Absent
a	6months	1	35dB	45dB	95%	Atype	Elevated	Absent
b	10months	1	50dB	55dB	80%	Atype	Absent	Absent
c	13months	1	65dB	75dB	60%	Atype	Absent	Absent
Autoimmune	16months	1	75dB	80db	55%	Atype	Absent	Absent
Disease d	17months	1	80dB	90db	40%	Atype	Absent	Absent
e								
a	7months	1	40dB	50dB	95%	Atype	Elevated	Absent
b	9months	1	45dB	55dB	80%	Atype	Elevated	Absent
Fabry's c	14months	1	60dB	70dB	75%	Atype	Absent	Absent
Disease d	15months	1	75dB	85dB	60%	Astype	Absent	Absent
e	19months	1	85dB	95dB	50%	Adtype	Absent	Absent

The PTA results reveal that significant pure sensorineural hearing loss in the diabetics, rheumatoid arthritis shows sensorineural to mixed hearing loss ,autoimmune disease leading to sensorineural hearing loss and fabry disease showed significant sensorineural to mixed hearing loss with the degree of hearing ranging between 45 to 90 dB. Speech audiometry was done to correlate the PTA results using same audiometer .Speech recognition threshold was administered using spondee words and the results were reported to be correlating with the PTA threshold .Speech discrimination score was done using PB words as stimuli and the outcome was in the range of 40-90%.

Tympanometric administration showed A type tympanogram in diabetics indicating no conductive pathology, some cases of rheumatoid arthritis and fabry disease showed As type and Ad type tympanogram and some cases are found to have A type tympanogram indicating normal, ossicular chain discontinuity and stiffness. Reflexometry results were found to be elevated and absent in all the selected subjects. Otoacoustic emission testing reveals absent OAE's indicating the cochlear involvement in all cases. However, the subjects were with controlled variables following exclusion and Inclusion criteria, few cases falling into higher age range {as 58, 59} with? Impacting the hearing due to aging.

DISCUSSION

This study highlights that the medications used for the different types of metabolic disorders are found to have significant impact on auditory status resulting in sensorineural and mixed hearing loss .Out of the 4 groups of metabolic disorders in this study the mean of PTA of diabetic population was found to be 65dB reporting significant sensorineural hearing loss with correlating SRT and SDS, A type tympanogram indicating no conductive involvement ,marked effect on otoacoustic emissions showing absent OAE's and the reflexes were reported to be absent and elevated .The diabetics with 6months of exposure to drugs showed less prominent sensorineural hearing loss with 45 dB sensorineural hearing loss when compared to 2years exposure to drugs showed significant sensorineural hearing loss with 90dB threshold.

In the same way subjects who were exposed to medications for rheumatoid arthritis showed a mean 57dB PTA 2 reporting sensorineural to mixed hearing loss with good correlation with SRT and SDS , A type, As type, Ad type tympanograms indicating conductive pathology in some subjects ,with absences of OAE's and the reflexes were elevated and absent. However the subjects with 6months of exposure showed mild sensorineural hearing loss with no conductive involvement when compared to subjects with 2years of exposure showed prominent mixed hearing loss. Mean average of subjects with exposure to medication for autoimmune disease according to the study PTA 4 is 61dB with good SRT and SDS correlation, subjects has A type tympanogram, with no conductive involvement and absent OAE's. Comparison within the group showed that long duration of medication has progressive hearing loss. Mean average of subjects with exposed to medication for Fabry 's disease PTA4 is 61dB with good SRT and SDS correlation, A type ,As type and Ad type tympanogram with marked conductive involvement and absent OAE's. Results have shown that medication initially resulted in sensorineural hearing loss but prolongation resulted in conductive involvement also leading to mixed hearing loss.
However, this small experimental investigation reported that the metabolic disorder medications have significant impact on the cochlear physiology with 65dB in diabetics, 57 in rheumatoid arthritis, 61dB in autoimmune disease and fabry's disease. This study has subjectively found that the increased duration of medicines resulted the hearing loss from sensorineural hearing loss to mixed hearing loss.

Clinical Implications

This study helps to make the general population to be aware of the side effects of metabolic disorder medications. The metabolic disordered population should undergo follow up audiometric test to rule out impairment in hearing.

Limitations

- This study has revealed that out of the 4 groups of metabolic disorders the diabetic population will have more predominant feature of sensorineural hearing loss

however for this study as an experimental basis samples are limited.

- Gender could not be generalized due to the small samples distribution.
- The same study can be carried as a longitudinal study to know the impact of medication on the impairment in hearing.

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