



SENSORINEURAL HEARING LOSS IN ISCHEMIC STROKE - A LONGITUDINAL OBSERVATIONAL STUDY IN A TERTIARY CARE HOSPITAL.

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ABSTRACT

Hearing impairment commonly involves dysfunction of the inner ear or auditory nerve, a condition known as sensorineural Hearing loss (SNHL). A longitudinal observational study of 38 stroke patients was conducted at a tertiary care hospital for a period of 6 months to know the proportion of sensorineural hearing loss in stroke patients and also the progression of hearing loss during the recovery period of stroke. Clinical & audiological evaluation was done for all patients and they underwent pure tone audiometry at serial intervals of 1st, 2nd and 3rd month from the date of diagnosis of stroke. The proportion of sensorineural hearing loss in stroke patients was found to be 60%. On comparison of serial pure tone audiometry readings, it was observed that hearing loss improved significantly during the recovery period of stroke. This study concluded that high proportion of sensorineural hearing loss in stroke patients indicates the importance of screening for hearing loss to improve the rehabilitation as well as quality of life post stroke.

KEYWORDS : Sensorineural Hearing loss, Stroke, pure tone audiometry

INTRODUCTION:

Helen Keller described deafness as the loss of the most vital stimulus- the sound of the voice that brings language, sets thoughts astir and keeps us in the intellectual company of man¹. Hearing loss is the third leading chronic disease worldwide after arthritis and hypertension. Hearing impairment commonly involves dysfunction of the inner ear or auditory nerve, a condition known as sensorineural Hearing loss (SNHL). A loss of more than 30 decibel in at least three adjacent frequencies occurring within three days or less is defined as sudden sensorineural hearing loss².

Sensorineural hearing loss is one of the most common clinical disorders and is associated with a multiple aetiologies. Because of the wide range of genetic, infectious, vascular, neoplastic, traumatic, toxic, iatrogenic, degenerative, immunologic and inflammatory pathologies that can affect the cochlea, a systematic approach is crucial to identification of the responsible aetiology.

Ischemic stroke is the acute occlusion of an intracranial vessel causing reduction in blood flow to the brain region it supplies³. Recent studies indicate that SNHL could be an early warning sign of stroke, more specifically the one which is caused by infarction of anterior inferior cerebellar artery. Physiologically inner ear is more sensitive to ischemia.

Sensory neural hearing loss is a common entity in stroke patients which may impact on patient communication and may predict long term patient outcome after stroke. So given a potential link between SNHL and stroke, an early detection of sensorineural hearing loss could be a guiding light in rehabilitation and recovery period. So here we are conducting this study to summarize the proportion of SNHL in ischemic stroke.

OBJECTIVES:

- To determine the proportion of patients presenting with sensorineural hearing loss after first episode of ischemic stroke.
- To evaluate the progression of hearing loss in stroke patients during recovery period.

Methodology:

A longitudinal observational study conducted at the teaching hospital of Mandya Institute of Medical Sciences from January 2022 to June 2022. 38 consecutive newly detected Ischemic stroke patients admitted in intensive care unit or medicine ward were selected for the study. Patients of age 18 years and above, newly diagnosed with Ischemic stroke by clinical features and CT imaging who gave informed consent were selected. Study was initiated after approval from the institutional ethics committee. Informed written consent was taken from the study subjects after explaining to them the plan and intention of the study in the language best known to them.

Inclusion criteria:

- Patients of age 18 years and above, newly diagnosed with ischemic stroke by clinical features and Computerized Tomography (CT) imaging.
- Patients who give informed consent.

Exclusion criteria:

- Patients aged above 80 years.
- Patients presenting with second episode or after stroke.
- Patients without word logical contact (aphasia, dementia, neurodegenerative changes).

A detailed history was taken and thorough clinical examination was done for all patients. Findings were noted and patients were reviewed after a period of 1 month from the date of diagnosis of Ischemic stroke for audiological evaluation (Pure Tone Audiometry-PTA). They were followed up with serial audiograms at 2nd (PTA 2) and 3rd month (PTA 3) and results were compared. In case of bilateral hearing loss, ear with higher value of pure tone average was taken for further evaluation and analysed according to appropriate statistical tests.

Table 1- Who Classification of Degree of Hearing Loss

DEGREE OF HEARING LOSS	HEARING THRESHOLD (PTA) IN DECIBEL (db)
Normal	10-25 db
Mild	26-40 db
Moderate	41-55 db

Moderately Severe	56-70 db
Severe	71-90 db
Profound	>90 db

RESULTS:

A total of 38 stroke patients were observed of which 23 patients had sensorineural hearing loss (60%).

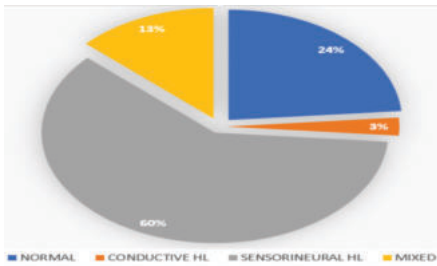


Figure 1- Type of Hearing Loss In Stroke Patients

The mean age for stroke patients was 54.28 years with 31.5% (n=38) patients of age more than 60 years. Among SNHL patients Mean age was 58.69%. Out of 23 SNHL patients 39.13% were of age more than 60 years, youngest was 26 years old and the oldest was 64 years.

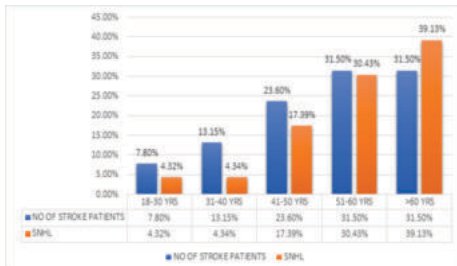


Figure 2- Age Distribution of Stroke Patients And Sensorineural Hearing Loss

Among stroke patients with SNHL most common degree of hearing loss was Moderate type with an incidence of 43.4% followed by moderately severe which was 34.78%. Severe and Profound hearing loss were least observed with an incidence of 4.34% each.

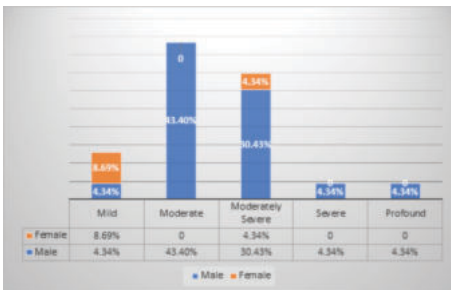


Figure 2- Severity of Hearing Loss In Stroke Patients

Progression of hearing loss was assessed during the stroke recovery period. Comparison analysis of Pure tone audiometry values of 1st and 2nd visit by paired t test demonstrated significant improvement in hearing with mean difference (M= -1.46 ; P<.05). Similarly comparison between PTA1 and PTA3, PTA2 and PTA3 also showed a significant improvement in hearing (M=-3.82; P<.05).

Table 2- Comparison of Pure Tone Audiometry Values Between First Visit And Follow Up Visits

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Comparison 1	PTA 1	53.543	23	14.0014	2.9195
	PTA 2	52.087	23	14.7003	3.0652

Comparison 2	PTA 2	52.087	23	14.7003	3.0652
	PTA 3	49.717	23	16.0953	3.3561
Comparison	PTA 1	53.543	23	14.0014	2.9195
	PTA 3	49.717	23	16.0953	3.3561

Table 3- Paired Samples Test

		T	Df	P value
Comparison 1	PTA 1 - PTA 2	3.392	22	.003
Comparison 2	PTA 2 - PTA 3	3.299	22	.003
Comparison 3	PTA 1 - PTA 3	3.714	22	.001

(T= sampling distribution, Df= degrees of freedom)

Based on CT brain findings, vascular territory involvements in the area of ischemia or infarct of brain was noted in all patients. Among these 38 patients, Middle cerebral artery (MCA) involvement was found in -73.6%, Anterior cerebral artery (ACA) in (23.6%) and Posterior cerebral artery (PCA) in 5.2%. 16(69.5%) SNHL patients had MCA territory involvement whereas 5(21.7%) had ACA and 2(8.6%) had PCA territory involvement. Out of 16 MCA territory stroke patients 81.25% had significant improvement in hearing during the course of stroke recovery.

Table 4 -distribution of Vascular Territory Involvements In Ischemic Stroke

INVOLVED TERRITORY-CT SCAN	STROKE PATIENT S(n=38)	STROKE PATIENTS WITH SNHL(n=23)
ANTERIOR CEREBRAL ARTERY(ACA)	9	5
MIDDLE CEREBRAL ARTERY (MCA)	27	16
POSTERIOR CEREBRAL ARTERY(PCA)	2	2

DISCUSSION

An attempt was made to analyse the proportion and progression of SNHL in stroke patients in this study. It was observed that 60% stroke patients had SNHL in this study compared to 73.3% patients in a study by Przewozny et al⁴. Solange et al also depicted identical results of prevalence of SNHL in aphasic patients after stroke⁵. We also noticed a significant improvement in hearing during the recovery period of stroke on comparing the serial PTA readings. In our present study we came into the conclusion that MCA territory infarct is the leading cause (69.5%). A similar study conducted by Nehzat koohi et al to determine type of hearing loss after infarction, Anterior inferior cerebellar artery territory stroke was the leading cause accounting for 83% of the cases. They also stated that hearing loss has been identified in approximately 60-80% of stroke sufferers⁵. The risk of both hearing loss and Cerebrovascular accident (CVA) increases with age⁶. Age related hearing loss is caused by deficits in hair cells, cochlear neurons, stria vascularis, a combination or aging itself⁷. This can explain the higher proportion of sensorineural hearing loss in older subjects in our study. A prospective study conducted at medical university of Gdansk concluded that highest risk of hearing loss in the group of ischemic stroke patients occurred at older people, particularly men with tinnitus, lacunar stroke, multiple bilateral ischemic foci and arterial hypertension⁴. Though we noticed similar results in terms of demographic characteristics, other comorbid conditions such as arterial hypertension, blood cell counts, diabetes melitus can be significant risk factors for development of SNHL in ischemic stroke.

Acute occlusion of an intracranial vessel causes reduction in blood flow to the brain region it supplies. The magnitude of the flow reduction is a function of collateral blood flow, and this depends on individual vascular anatomy, the site of the occlusion, and systemic blood pressure⁸. A Retrospective analysis of clinical data of ischemic stroke patients conducted by Yan Deng et al concluded that patients were mostly middle-

aged and elderly with no typical stroke symptoms, and a history of stroke and hypertension increased the risk of hearing loss⁹.

Sensorineural hearing loss indicates an abnormality of the cochlea, auditory nerve, or higher aspects of central auditory perception or processing¹⁰. There are only a limited number of studies addressing this subject so far. Even though Sensorineural hearing loss is associated with multitude of etiologies, vascular pathology has brought considerable attention. Commonly the pathology in SNHL involves anterior inferior cerebellar artery(AICA). AICA also gives rise to internal auditory artery which is the principal blood supply to the labyrinth.¹ Because cochlea is provided with a terminal capillary bed and is not supplied by collateral vessels, interrupted blood flow in stroke will damage the cochlear hair cells and results in hypoxia or ischemic damage¹¹. A such study conducted by A.Ciobra et al on sudden hearing loss and the risk of subsequent ischemic stroke reported that SSNHL cannot be considered as predisposing or predictive factor regrading stroke¹².

According to the current global burden of disease data on stroke, in 2016 there were almost 116 million DALYs (disability adjusted life years) due to stroke. Hearing loss that is not immediately apparent after stroke may remain undetected and uncorrected affecting the overall communication of the patient. Therefore, post stroke rehabilitation protocols should include screening for hearing before the patient leaves the stroke ward, including a simple set of hearing-related questions and a screening audiogram to address the hearing needs of stroke survivors¹³.

Limitations

- 1) Only few demographical characteristics were included in this study.
- 2) Time gap between the onset of stroke and hearing evaluation could not be assessed, hence could not comment on incidence of sudden SNHL.

CONCLUSION

Most of the times auditory impairments in stroke patients remains unnoticed and can have adverse effects on patient communication and rehabilitation. High proportion of SNHL and significant improvement in hearing loss during the recovery period of stroke indicates the importance of screening for hearing loss to improve the rehabilitation as well as quality of life post stroke.

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