Research Article

PREVALENCE OF SENSORINEURAL HEARING LOSS AMONG STROKE PATIENTS

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DOI:
10.38106/LMRJ.2024.6.3-04
Received: 23.03. 2024
Accepted: 21.08.2024
Published: 30.09.2024

ABSTRACT

This study was designed to determine the prevalence of sensorineural hearing loss among stroke patients. A cross-sectional analytical study was conducted. Medicine department of HMC Peshawar and lady reading hospital (LRH) in Peshawar. Total 224 diagnosed stroke patients were selected by non-probability purposive sampling technique. 20 and above age group male and female were included. Transient ischemic, psychological, and congenital stroke patients were excluded. Pure Tone audiometry (PTA) was done using pure tone audiometer to identify type of hearing loss. The Study was conducted at audiology Department of The University of Lahore for the duration of six months from 22nd March2023 to 22nd August2023. Out of 224 stroke patients, 168 were ischemic and 56 were hemorrhagic type.15 patients had conductive hearing loss,111 had sensorineural hearing loss,21 had mixed hearing loss while 66 were having normal and 11 were having high frequency sensorineural hearing loss. This study showed that there was no significant association between sensorineural hearing loss and stroke.

Key words: Sensorineural hearing loss, Ischemic stroke, Hemorrhagic stroke.

INTRODUCTION:

Stroke is the predominant neurological disorder and a primary contributor to disability; nearly 66% of stroke survivors depart the hospital with disabilities. Stroke can impact every aspect of the auditory system, from the inner ear to the central auditory pathways, leading to diverse forms of hearing impairment including peripheral hearing loss, disrupted auditory processing, and cortical deafness (1).

Within the stroke population, a significant majority of stroke patients experience hearing loss. Formby et al. (1987) conducted a study specifically focusing on hearing impairment linked directly to stroke, excluding patients with prior otologic conditions or occupational noise exposure(2). Stroke can impact various levels of the auditory pathway, resulting in deficits in hearing reception and/or perception. Sudden-onset hearing loss following a stroke in the vertebrobasilar territory and/or the low brainstem is a relatively uncommon neurological impairment. Cortical or central deafness, though even rarer, can also occur. Nevertheless, research on stroke populations suggests that hearing loss is prevalent, with a past history of stroke correlating with an increased likelihood of experiencing hearing impairment, a trend not as pronounced in the general population (3). There have been cases indicating that sudden sensorineural hearing loss (SSNHL) can serve as a warning sign for vertebrobasilar infarction. The sudden onset and potential reversibility of SSNHL, combined with the vascular vulnerability of the cochlea, have led to speculation about the relationship between SSNHL and stroke. Some studies have included subjects with a history of previous stroke before the onset of SSNHL, and the study populations often exhibit high rates of comorbid conditions such as hypertension and diabetes(4). A stroke occurs when blood run to the brain is disturbed, either due to an obstruction in a blood vessel (ischemic stroke) or bleeding in the brain (hemorrhagic stroke). When blood flow is disrupted, brain cells are damaged or die, resulting in various neurological symptoms(5).

Ischemic stroke is about 85% of all cases. The inadequate blood flow and oxygen can induce the death of brain cells, leading to permanent brain damage. When a blood vessel in the brain bursts, resulting in a hemorrhagic stroke, leads to disability or death. Hypertensive is a common reason of hemorrhagic stroke. A transient ischemic attack (TIA) occurs when there is a transitory disruption in the blood flow to the brain. The signs of a TIA are lasted for fewer hours or days, usually less than an hour. However, a TIA is an indication that a more serious stroke may occur (6).

Stroke survivors are required tertiary prevention in form of rehabilitation and disability limitation (7). Early detection of hearing impairment is crucial for maximizing outcomes in post-stroke rehabilitation, underscoring the need for clinical guidelines to advocate for hearing screening in stroke units(8). The estimation of the auditory system is indeed less common despite the severe condition of the patient and the aims of neurologic treatment. Audiologic examinations often suggest that sudden deafness, tinnitus, and impairment of sound localization are typically due to dysfunction of the cochlea resulting from stroke to the inner ear and central auditory pathways (3). Sensorineural hearing loss (SNHL), also known as nerve-related hearing loss, is indeed defined as being caused by damage to the hair cells in the cochlea, spiral ganglia, cranial 8th nerve (auditory nerve), or the central processing auditory centers of the brain. This type of hearing loss can occur due to various factors and can range from mild to profound, affecting an individual's ability to hear sounds clearly and understand speech. (9) Sudden hearing loss can stem from various conditions spanning from minor issues such as earwax buildup to more serious conditions like stroke(10). Hearing has multiple function doing sound analysis in the spatial, temporal, and spectral domain. This necessitates the transfer of information from the ear to the auditory cortex, where it is processed to aid sound detection and perception along with memory, focus and learning lead to hearing cognition. (11) Auditory problem is frequent after a stroke due to loss of peripheral hearing or a central processing of sound (CAPD). Untreated hearing issue has negative impact relating to patient interaction and rehabilitation. The audiological evaluation of all patients with stroke are time consuming and costly. Therefore, a quick hearing test is needed (8).

This study aims to investigate the prevalence of sensorineural hearing loss (SNHL) among stroke patients. Rationale of the study is to address that early identification and management of SNHL can improve patient outcomes and reduce healthcare costs. Furthermore, understanding the relationship between stroke and SNHL can inform the development of guidelines for hearing screening and management among stroke patients. Hearing impairment can significantly impact their quality of life, communication, and rehabilitation outcomes.

Suktara Sharma, et.al. conducted research on hearing disorder patients in India in 2021with sensorineural hearing loss in stroke patients. All patients underwent Pure Tone Audiograms within 15 days after the stroke's beginning, measure of hearing sensitivity, was found to be significantly higher in both ears of stroke patients compared to control participants (with a mean of 44.0 ± 12.1 dB for patients with stroke versus 36.1 ± 11.4 dB for control participants; $p = 0.001$) (12). Study conducted by Herng-Ching Lin et al. in 2018 between sudden sensorineural hearing loss (SSNHL) and the risk of stroke followed for five years. The results showed 8.7% of patients had strokes, with SSNHL (13). The association between stroke and SNHL are not fully assumed, because SNHL may result from damage to the inner ear due to low blood flow to the cochlea or inflammatory response may lead to oxidative stress and damage to the hair cells in the cochlea during stroke. Although, the frequency of SNHL in stroke patients is relatively high and may have important implications for their functional outcomes and superiority of life. Additional research is needed to better understand the primary mechanisms and to develop effective strategies for prevention and treatment of SNHL in stroke patients (14).

Methodology:

Cross-sectional analytical study on stroke participants was conducted. The investigation was carried out during a six-month period, from 22nd March 2023 to 22nd August 2023 after the approval of REC. Non-probability random sampling technique was used in this study. Men and women above age 20years were included. Patients with sensorineural hearing loss, ischemic stroke, and hemorrhagic stroke were included. Patients with conductive hearing loss, mixed hearing loss, transient ischemic stroke, congenital hearing loss and psychological hearing disorders were excluded. Pure tone audiometer and auditory brainstem response was used to measure the type

and degree of hearing loss. Questionnaire of hearing threshold related was filled out by participant including patient demographic data name, age, education and other relevant personal and Audiological information.

RESULTS:

This study included a total of 224 patients with stroke, comprising 94 males (42%) and 130 females (58%). Ischemic stroke type (75%, n=168) and hemorrhagic stroke type (25%, n=56) were concluded. Regarding hearing loss, 49.6% (n=111) of the patients had sensorineural hearing loss, 29.5% (n=66) had normal hearing, 9.4% (n=21) had mixed hearing loss, 6.7% (n=15) had conductive hearing loss, and 4.9% (n=11) had high frequency sensorineural hearing loss.

Table 1: Demographics (gender, types of strokes, test performed)

Gender			
		Frequency	Percentage
	Male	94	42.0
	Female	130	58.0
	Total	224	100.0
This table shows out of 224 patients, 94 were male and 130 were female.			
Types of strokes			
		frequency	Percentage
	Ischemic stroke	168	75
	Hemorrhagic stroke	56	25
	Total	224	100
Test performed			
		frequency	Percent
	ABR	78.4	35%
	Puretone audiometry	145	65%
	total	224	100%

Table 2: Types and severity of hearing loss

Type of Hearing loss		
	Frequency	Percentage
Conductive hearing loss	15	6.7
Sensorineural hearing loss	111	49.6
Mixed hearing loss	21	9.4
Normal	66	29.5
High frequency sensorineural hearing loss	11	4.9
Total	224	100.0
Severity of hearing loss		
	Frequency	Percentage
Mild	22	9.8
Moderately severe	36	16.1
Severe	52	23.2
Profound	33	14.7
Normal	7	3.1
Total	74	33.0
	224	100.0

Table 3: Association between type of stroke with type and degree of hearing loss

		Type of hearing loss					p-value
		Conductive hearing loss	Sensorineural hearing loss	Mixed hearing loss	Normal	High frequency sensorineural hearing	
Type of stroke	Ischemic	11	79	16	53	9	0.705
	Hemorrhagic	4	32	5	13	2	
Total		15	111	21	66	11	

		Degree of hearing loss						p-value
		Mild	Moderate	Moderately severe	Severe	Profound	Normal	
Type of stroke	Ischemic	15	29	36	22	6	60	0.395
	Hemorrhagic	7	7	16	11	1	14	
Total		22	36	52	33	7	74	

DISCUSSION:

Sensorineural hearing loss (SNHL) is a common comorbidity in stroke patients, which can harmfully affect their value of life and communication abilities. The prevalence of SNHL in stroke patients has been studied in several research studies, and there have been discussions on the possible mechanisms underlying this association. Findings by Herng-Ching Lin et al. in 2018, sudden sensorineural hearing loss SSNHL and the risk of stroke followed for five years. The results showed 8.7% of patients had strokes, with SSNHL (13). A study conducted by Nehzat Koohi et al. revealed that among stroke patients, the most prevalent type of hearing impairment was a combination of peripheral hearing loss and Central Auditory Processing Disorder (CAPD), particularly prominent in the 61 to 80-year-old subgroup, affecting 55% of individuals. Additionally, auditory processing deficits were observed in 40% of stroke patients aged 18 to 60 years, significantly exceeding the prevalence found in control group (7). A pilot study conducted by Suktara Sharma et al. revealed notable hearing impairment among stroke patients compared to age and sex-matched controls, with a similar prevalence of cardiovascular risk factors. This impairment was particularly noteworthy in a predominantly anterior circulation stroke population. The study suggested that undetected hearing loss could potentially influence post-stroke functional recovery (12). Qin fang et al. exposed that Individuals with severe or greater hearing loss faced a heightened risk of ischemic stroke, with an increase of 69% at speech frequency and 52% at high frequency. Moreover, severe or greater hearing loss was linked to approximately a twofold risk of hemorrhagic stroke compared to those with normal hearing, particularly at speech frequency (15).

While in our study, out of 224 patients with stroke, 168(75%) were ischemic and 56(25%) were hemorrhagic type. 15(6.7%) patients had conductive hearing loss, 111(49.6%) had sensorineural hearing loss,21(9.4%) had mixed hearing loss while 66 were having normal and 11(4.9%) were having high frequency sensorineural hearing loss ($p>0.05$). Prevalence for mixed hearing loss and conductive hearing loss show the possibility of disorder before

stroke but it was not diagnosed. Data was collected in a single sitting. A specific targeted population was observed in this study which restricted generalizability

CONCLUSION:

The study concluded that there were no significant association between the type and degree of hearing loss among stroke patients. This research will be helpful for researchers in determining the prevalence of different type of hearing loss in patients with stroke over wide population. It will also help to investigate the stroke-related hearing loss, as this can aid in the development of effective prevention and treatment strategies. Overall, this research can contribute to improving the overall care and outcomes for stroke patients.

ACKNOWLEDGEMENTS:

I am highly thankful to my Head of the department for their cooperation and encouragement.

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