Section: ENT

Original Research Article

AUDIOVESTIBULAR SYMPTOMS IN PATIENTS WITH ANTERIOR INFERIOR CEREBELLAR ARTERY LOOPS ATTENDING A TERTIARY CARE CENTRE IN SOUTH KERALA

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ABSTRACT

Background: Objective: To determine the proportion of audio vestibular symptoms among patients with Anterior inferior cerebellar artery (AICA) loop diagnosed radiologically by Magnetic resonance imaging (MRI).
To determine the association between the type of AICA loop and audio vestibular Symptoms.
Materials and Methods: All patients presented to Ear, Nose, Throat (ENT) department with hearing loss, tinnitus, vertigo and evaluated with an MRI for AICA loop and also those patients with incidentally detected AICA loop from Radiology department were selected for the study. Detailed ENT examination including clinical vestibular examination and Pure tone audiogram was done.
Results: Patients with type 1 AICA loop presented with hearing loss, tinnitus and vertigo. 75% of patients had tinnitus ,60% vertigo and 69.6% had hearing loss. No significant association was seen between AICA loop and symptoms of tinnitus and vertigo. However, a statistically significant association is observed between AICA loop type and hearing loss in the right ear ($p = 0.036$).
Conclusion: In this study hearing loss was only symptom influenced by AICA loops. Type I AICA loop showed more audiovestibular symptoms. The present study showed no direct association between AICA loops identified on MRI and audiovestibular symptoms.
Keywords: Anterior inferior cerebellar artery, tinnitus, vertigo.

INTRODUCTION

The Anterior inferior cerebellar artery (AICA) loop is a vascular structure that enters or abuts the internal auditory canal (IAC) or closely approximates the vestibulocochlear nerve complex. These loops may cause neurovascular compression, potentially leading to audiovestibular symptoms such as sensorineural hearing loss, tinnitus, and vertigo. The proposed underlying mechanism is ephaptic depolarization of the vestibular nerve, induced by microtrauma and demyelination caused by chronic pressure on the nerve from an adjacent blood vessel. This provokes afferent stimulation and vertiginous spells.[1]

The cerebellopontine cistern is a space in which neurovascular structures such as the trigeminal nerve, facial nerve, vestibulocochlear nerve, and anterior inferior cerebellar artery (AICA) are in close relationship with each other. Compression of these cranial nerves by vessels causes various neurological symptoms. Janetta first suggested that compression of a vascular loop by the AICA on the vestibulocochlear nerve can cause hearing loss, tinnitus, vertigo.[2]

High-resolution, thin-section magnetic resonance imaging (MRI) and magnetic resonance angiography (MRA) are widely used key tools for visualizing the IAC and cerebellopontine angle (CPA) in patients with audiovestibular symptoms. These modalities provide critical clues about the anatomical

relationship between the vestibulocochlear nerve and the surrounding vasculature in the temporal bone.

The relationship between vascular loops in the posterior fossa, IAC, and neuro-otologic symptoms are well documented in literature.[3,4] However, the symptoms predicted by specific features of vascular loops remain mostly unclear. In this study, we aimed to study the effect of radiologically found Anterior inferior cerebellar artery (AICA) vascular loop on audio vestibular symptoms.

MATERIALS AND METHODS

A cross-sectional study was conducted in the department of ENT, Pushpagiri medical college, Thiruvalla from May 2023 to November 2024, after obtaining ethics committee clearance. Informed consent was taken from all patients studied.

Inclusion Criteria

1. Patient of age more than 18 years and less than 70 years.
2. Patients presented to department of ENT with hearing loss, tinnitus, vertigo in whom MRI was done.
3. Patient presented to Radiology department with incidentally found AICA loops on MRI.

Exclusion Criteria

1. Patients with previous history of otologic surgery.
2. Patients with temporal bone and acoustic trauma.
3. Patient with prior neurological complications like CVA, Seizure, Guillain Barre syndrome, meningitis etc.

Detailed ENT examination including vestibular system examination was done. Pure tone Audiometry test was done in all patients. Pure tone average (PTA) was calculated from auditory thresholds recorded at 0.5,1 and 2 kHz and high frequency hearing at level at 4 and 8 kHz were recorded. Radiological evaluation was done with 1.5 Tesla MRI. Three-dimensional MRI sequence and multiplanar reconstructions were done to assess for the vascular loop of AICA in the CPA cistern and extension of the AICA loop into the IAC. The AICA loop was graded according to the Chavda classification.[5]

Statistical Analysis

Data was properly coded and analysed using statistical software SPSS Version 25. Qualitative variables were summarized as percentages and for quantitative variables mean with standard deviation were calculated. A p value of <0.05 was considered as statistically significant.

RESULTS

This study included 69 patients with symptoms of tinnitus, vertigo, hearing loss

Table 1: Distribution of audiovestibular symptoms

Variables		Frequency	Percent
Tinnitus	Right	4	5.8
	Left	8	11.6
	Both	4	5.8
	No Tinnitus	53	76.8
Vertigo	Absent	29	42
	Present	40	58
Hearing Loss	Right	5	7.3
	Left	9	13
	Both	9	13
	No Hearing Loss	46	66.7

The study population consisted predominantly of females (65.2%). Among auditory symptoms, the majority of individuals (76.8%) had no tinnitus, while 11.6% reported it in the left ear, 5.8% in the right ear, and 5.8% in both ears. Vertigo was the initial presentation in 58% of cases, indicating a significant prevalence. Hearing was normal in most individuals (66.7%), whereas 13% had left ear sensorineural hearing loss, 7.3% had right ear sensorineural hearing loss, and 13% experienced bilateral hearing loss. Table no:1

Table 2: Distribution of Audio vestibular Symptoms across various AICA Loops

Symptoms	AICA Loop Type		
	Type 1	Type 2	Type 3
Tinnitus (n=16)	12 (75%)	9 (56.3%)	1 (6.3%)
Vertigo (n=40)	24 (60%)	24 (60%)	2 (5%)
Hearing Loss (n=23)	16 (69.6%)	13 (56.5%)	4 (17.4%)

In patients with Type 1 ,75% had tinnitus, 60% had vertigo, and 69.6% had hearing loss. Type 2 loops also showed a notable frequency, particularly for tinnitus (56.3%) and vertigo (60%). In contrast, Type 3 loops had the lowest frequency, with only 6.3% with tinnitus, 5% with vertigo, and 17.4% with hearing loss. Table no : 2

Table 3: Association Between AICA Vascular Loop Types and Audiological Symptoms

Symptoms		RIGHT AICA Loop					LEFT AICA Loop				
		No AICA Loop	Type 1	Type 2	Type 3	p value	No AICA Loop	Type 1	Type 2	Type 3	p value
Tinnitus in the Corresponding Ear	Absent	13 (21.3%)	24 (39.3%)	21 (34.4%)	3 (4.9%)	0.859	12 (21.1%)	21 (36.8%)	22 (38.6%)	2 (3.5%)	0.182
	Present	1 (12.5%)	3 (37.5%)	4 (50%)	0 (0%)		0 (0%)	7 (58.3%)	4 (33.3%)	1 (8.3%)	
Hearing Loss in the Corresponding Ear	Absent	14 (25.5%)	20 (36.4%)	20 (36.4%)	1 (1.8%)	0.036	10 (19.6%)	20 (39.2%)	20 (39.2%)	1 (2%)	0.367
	Present	0 (0%)	7 (50%)	5 (35.7%)	2 (14.3%)		2 (11.1%)	8 (44.4%)	6 (33.3%)	2 (11.1%)	

The results showed that there was no significant association between AICA loop types and tinnitus in the right ear (p = 0.859). However, a statistically significant association was observed between AICA loop type and hearing loss in the right ear (p = 0.036). Notably, hearing loss was most prevalent in Type 1 (50%) and Type 2 (35.7%) loops, while no hearing loss is reported in patients without an AICA loop, indicating a possible link between vascular loop types and auditory dysfunction. Table no: 3

The results in left ear showed no significant association between AICA loop type and tinnitus (p = 0.182) or hearing loss (p = 0.367), suggesting that these auditory symptoms are not strongly influenced by the presence or type of AICA loop in the left ear. However, tinnitus appears to be more common in Type 1 loops (58.3%), while hearing loss is most frequently observed in Type 1 (44.4%) and Type 2 (33.3%) loops. Table no: 3

Table 4: Association Between AICA Vascular Loop Types and Vertigo

Audio vestibular Symptoms		AICA Loop				p value
		Only Type 1	Only Type 2	Only Type 3	Any Types	
Vertigo	Absent	10 (34.5%)	6 (20.7%)	1 (3.4%)	12 (41.4%)	0.334
	Present	14 (35%)	15 (37.5%)	1 (2.5%)	10 (25%)	

In contrast, among those with vertigo, Type 2 was the most frequently observed type (37.5%), closely followed by Type 1 (35%), 25% of patients with vertigo had different types of loops in each ear. The p-value of 0.334 indicates that there is no statistically significant association between the presence of vertigo and the AICA loop type. Table no: 4

Among them seven patients showed positional nystagmus which was triggered by change in head position. Out of them, three showed spontaneous horizontal nystagmus also. Another patient showed hyper ventilation induced horizontal nystagmus.

DISCUSSION

Tinnitus, vertigo and hearing loss are well known classic triad of audio vestibular symptoms involving inner ear disease. It has been suggested that microvascular compression of the cranial nerves by vascular structure may be the cause of these clinical findings. Janetta et. al has suggested that compression of vestibulocochlear nerve with AICA loop can cause hearing loss, tinnitus, vertigo.[2]

Ectopic impulse generation causes focal demyelination, which results in abnormal electrical discharges leading to hyperexcitability of the vestibular nerve, causing spontaneous firing and resulting in brief, recurrent vertigo attacks. AICA loop can also cause vestibular paroxysmia, which is a brief and frequent attack of vertigo accompanied by the features of short attacks of rotatory or postural vertigo lasting for seconds to minutes with instability of posture and gait. Attacks may often be triggered by particular head positions or hyperventilation, and may be influenced by changing the head position.[6]

In the present study total sample size was 69. The study population included age group from 18 to 70 years with mean age of presentation at 48.41 years, which is comparable to study conducted by Gultekin S et al,[7] Among the study population, females showed a higher prevalence of audiovestibular symptom similar to the study conducted by De Abru et al.[8]

On analysing types of AICA loops, type I loops (56) were the most common. Type I AICA loop showed highest prevalence of symptoms. Tinnitus is the most common symptom in Type 1 AICA loops (75%). According to Choe et al,[9] higher prevalence of symptoms was noted in Type I and type 2 AICA loops.

On analysing the correlation between types of AICA loops and tinnitus, no significant association was found in the present study (p value – 0.568). The study done by Gultekin et al.7 also showed no association (p value – 0.05). However, the study conducted by Gorri et al,[10] found association between AICA loops and tinnitus (p values - 0.043).

In present study, 33.3% of patients experienced hearing loss. 65.2% of them had sensorineural hearing loss. The study done by De stadio and Ezerenlin et al,[11] also showed association between hearing loss and AICA loop. In the present study comparing hearing thresholds assessed by pure tone audiometry and AICA loops, vascular loops

influenced the hearing thresholds on right side (p value – 0.035) and not on left. Correlation with hearing loss was noted in studies conducted by Gorrie et al,[11] and McDermott et al.[12]

In the present study there was no significant association found between vertigo and AICA loops (p value-0.334). 58% of patients in the present study had symptom of vertigo. Among them seven patients showed positional nystagmus with triggered by change in head position. Out of them, three showed horizontal nystagmus also. Another patient showed hyper ventilation induced horizontal nystagmus. These patients with nystagmus were diagnosed as vestibular paroxysmia. In study done by Berina Ihtijeruc et al,[13] in patients diagnosed with vestibular paroxysmia symptoms were triggered by positional changes like head movement, hyperventilation and caloric testing. Seven patients with nystagmus were treated with Lacosamide (100mg/day) showed symptomatic alleviation. In the study by Michael Strupp et al,[14] in patients with vestibular paroxysmia treatment with Carbamazepine (400 – 800 mg/day) or oxcarbazepine (300-600mg / day) gave symptomatic relief. In refractory cases of vestibular paroxysmia option were surgical microvascular decompression. Ryu et al,[15] in their study showed significant improvement in hearing loss and tinnitus after microvascular decompression.

CONCLUSION

In the present study hearing loss was only symptom influenced by AICA loops. Type I AICA loop showed more audiological symptoms. The present study showed no direct association between AICA loops identified on MRI and symptoms of tinnitus and vertigo.

Limitations

The study had a limited sample size which could affect the generalizability of findings to the general population. The study does not track progression, so it cannot determine if an AICA loop leads to worsening symptoms over time.

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