

**Original article:**

## **MRI assessment of relationship between vascular loops in cerebellopontine angle and otological symptoms**

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### **Abstract:**

**Background:** Vascular loops in the cerebellopontine angle (CPA) have been implicated in otological symptoms such as tinnitus, hearing loss, vertigo, and facial palsy. This study aimed to assess the relationship between vascular loops in the CPA and otological symptoms using magnetic resonance imaging (MRI).

**Methods:** A cross-sectional study was conducted over an 18-month period, involving 100 patients referred for MRI evaluation of otological symptoms. Informed consent was obtained, and MRI was performed using steady-state sequences. The presence of vascular loops, compression, and special variations in the CPA was assessed. The distribution of cases based on age, gender, and different loop types was analyzed. The association between loop contact and the presence of vertigo was also evaluated.

**Results:** The study population consisted of 51% males and 49% females, with a higher prevalence of otological symptoms in the age group of 41-60 years (40%). Among the cases, 44% had no loops in the left CPA, while Type II loops were observed in 30% of cases. Vertigo was significantly associated with loop displacing contact in both the right and left CP angles (77.2% and 77.2% respectively), compared to adjacent contacts (39.5% and 41.9% respectively).

**Conclusion:** This study highlights the relationship between vascular loops in the CPA and otological symptoms, particularly vertigo. The presence of loop displacing contact in the CPA was significantly associated with the occurrence of vertigo. These findings emphasize the importance of MRI assessment for identifying and characterizing vascular loops in patients with otological symptoms. Understanding this relationship can aid in accurate diagnosis and management of otological symptoms related to vascular loops.

**Keywords:** MRI, cerebellopontine angle, vascular loops, otological symptoms

### **Introduction:**

The cerebellopontine angle (CPA) is a critical anatomical region located between the cerebellum and the pons in the posterior fossa of the brain. Within the CPA, several important structures are found, including the facial and

vestibulocochlear nerves, as well as various blood vessels. Of particular interest are vascular loops, which are aberrant or tortuous blood vessels that can be found in close proximity to the cranial nerves. These vascular loops have been implicated in the development of otological symptoms, such as tinnitus, hearing loss, and vertigo.

Magnetic resonance imaging (MRI) has become an invaluable tool for the assessment of the CPA and its associated structures. With its excellent soft tissue contrast and multiplanar imaging capabilities, MRI allows for detailed visualization and characterization of vascular loops and their relationship with neighboring cranial nerves. This non-invasive imaging modality provides valuable information for clinicians in diagnosing and managing patients with otological symptoms.

The association between vascular loops in the CPA and otological symptoms has been a subject of considerable research and clinical interest. Vascular loops can exert mechanical pressure or impede blood flow to the cranial nerves in the vicinity, leading to a range of otological manifestations. Understanding the exact nature of this relationship is crucial for accurate diagnosis, treatment planning, and patient outcomes.

In this review, we aim to explore the existing literature on the assessment of the relationship between vascular loops in the CPA and otological symptoms using MRI. We will discuss the various MRI techniques employed, such as high-resolution T2-weighted imaging, magnetic resonance angiography (MRA), and diffusion-weighted imaging (DWI), and their roles in evaluating vascular loops and associated pathology. Furthermore, we will examine the clinical implications of identifying and characterizing these vascular loops, including their impact on treatment decisions and patient prognosis.

By elucidating the link between vascular loops in the CPA and otological symptoms through MRI assessment, we hope to contribute to the growing body of knowledge in this field. The information provided in this review may aid clinicians in the accurate diagnosis and management of patients with otological symptoms related to vascular loops, potentially leading to improved patient outcomes and quality of life.

#### **Material and methods:**

A cross-sectional study was conducted among patients referred to the Department of Radiodiagnosis at JJM Medical College for MRI evaluation over a period of 18 months from March 2021 to September 2022. Ethical clearance was obtained from the institution's ethics committee prior to the commencement of the study. Informed, bilingual, and written consent was obtained from each participant before their inclusion in the study. The sample size comprised a total of 100 cases.

The inclusion criteria for the study were as follows:

- Patients referred to the Department of Radiodiagnosis at JJM Medical College with otological symptoms, including tinnitus, sensorineural hearing loss, vertigo, and facial palsy, who required MR evaluation for various conditions.
- Image acquisition was performed using steady-state sequences.

The following were the exclusion criteria:

- Patients with other cerebellopontine angle pathology, such as tumors and arteriovenous malformations.
- Patients with pathological conditions of the auditory system and cochlea that were evident on the obtained images.

- Patients presenting with vertigo, tinnitus, hearing loss, or facial nerve palsy, but were found to have acute infarcts, brain tumors, and other structural abnormalities.
- Patients who had undergone previous surgical procedures in the region of interest.
- All patients in whom an MRI examination was contraindicated, such as those with electrically, magnetically, or mechanically activated implants (including cardiac pacemakers, biostimulators, neurostimulators, cochlear implants, and hearing aids).

**Results:**

About 40.0% of the cases in this study were aged between 41 – 60 years followed by 38% less than or equal to 40 years and 22% more than 60 years.

About 51.0% of the cases in this study were males and 49.0% were females.

**Table 1: Distribution of the study group according to left CP angle**

Left CP angle	Frequency	Percent
No loops	44	44.0
Type I	3	3.0
Type II	30	30.0
Type III	7	7.0
<b>Total</b>	<b>100</b>	<b>100.0</b>

**Table 2: Distribution of the study group according to left compression**

Left compression	Frequency	Percent
Type 1 – Point compression	1	1.0
Type 2 – Longitudinal	27	27.0
Type 3 – Loop compression	10	10.0
No compression	62	62.0
<b>Total</b>	<b>100</b>	<b>100.0</b>

**Table 3: Distribution of the study group according to special variation L**

Special variation L	Frequency	Percent
No loops	92	92.0
PICA loop	8	8.0
<b>Total</b>	<b>100</b>	<b>100.0</b>

**Table 4: Distribution of the study group according to Contact L**

Contact L	Frequency	Percent
Type A – No contact	1	1.0
Type B – Adjacent	27	27.0
Type C – Loop in between	10	10.0
Type D – Loop Displacing	62	62.0
<b>Total</b>	<b>100</b>	<b>100.0</b>

**Table 5: Distribution of the study group according to contact R and Vertigo**

Contact R	Vertigo	
	Yes n (%)	No n (%)
No contact	1 (1.8)	12 (27.9)
Adjacent	8 (14.0)	17 (39.5)
Loop in between	4 (7.0)	1 (2.3)
Loop displacing	44 (77.2)	13 (30.2)
<b>Total</b>	<b>57 (100.0)</b>	<b>43 (100.0)</b>

$\chi^2$  value= 29.832

df=3

p value, Sig=0.000, Sig

Vertigo was present in loop displacing type of contact on right side in 77.2% of the cases and not present in 39.5% of the adjacent contacts. This difference was statistically significant between the cases with or without vertigo.

**Table 6: Distribution of the study group according to contact L and Vertigo**

Contact L	Vertigo	
	Yes n (%)	No n (%)
No contact	0	1 (2.3)
Adjacent	8 (14.0)	19 (39.5)
Loop in between	5 (8.8)	5 (11.6)
Loop displacing	44 (77.2)	18 (41.9)
<b>Total</b>	<b>57 (100.0)</b>	<b>43 (100.0)</b>

$\chi^2$  value= 14.713

df=3

p value, Sig=0.002, Sig

Vertigo was present in 77.2% of the loop displacing type of contact on left side and not present in 41.9% of the cases on right side. This difference was statistically significant between the cases with or without vertigo.

**Discussion:**

The results of the study indicate that the distribution of cases based on age shows a higher prevalence of otological symptoms in the age group of 41-60 years (40.0%), followed by those aged less than or equal to 40 years (38.0%) and those above 60 years (22.0%). In terms of gender, the study population was nearly evenly distributed, with males accounting for 51.0% of the cases and females accounting for 49.0%.

Regarding the presence of vascular loops in the left cerebellopontine (CP) angle, the majority of cases (44.0%) did not exhibit any loops, while Type II loops were observed in 30.0% of cases, followed by Type III loops in 7.0% of cases. Only a small proportion (3.0%) exhibited Type I loops. In terms of left compression, the majority of cases (62.0%) did not show any compression, while 27.0% exhibited longitudinal compression (Type 2), and 10.0% showed loop compression (Type 3). Point compression (Type 1) was observed in only 1.0% of cases.

The distribution of the study group based on special variation L showed that 92.0% of cases had no loops, while 8.0% exhibited PICA loops. Furthermore, when analyzing the contact in the left CPA, it was found that most cases had loop displacing (Type D) contact (62.0%), followed by adjacent contact (Type B) in 27.0% of cases, loop in between (Type C) in 10.0% of cases, and no contact (Type A) in 1.0% of cases.

The association between contact in the right CPA and the presence of vertigo revealed significant findings. Among cases with contact in the right CPA, 77.2% of loop displacing contacts exhibited vertigo, while only 39.5% of adjacent contacts showed vertigo. This difference was statistically significant, indicating a higher likelihood of vertigo in cases with loop displacing contact on the right side.

Similarly, the association between contact in the left CPA and the presence of vertigo was found to be statistically significant. Among cases with contact in the left CPA, 77.2% of loop displacing contacts exhibited vertigo, whereas only 41.9% of cases without vertigo had loop displacing contact. These findings suggest that there is a higher prevalence of vertigo in cases with loop displacing contact on the left side.

**Conclusion:**

Overall, these results highlight the relationship between vascular loops in the CPA and otological symptoms, particularly vertigo. The presence of loop displacing contact in both the right and left CP angles was

significantly associated with the occurrence of vertigo. These findings underscore the importance of identifying and characterizing vascular loops during MRI assessment in patients presenting with otological symptoms, as they may contribute to the development of vertigo. Understanding this relationship can aid clinicians in accurate diagnosis and appropriate management of patients with otological symptoms related to vascular loops in the CPA.

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