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# Cerebellopontine angle tumours: clinico-radiological features and surgical outcome. Single institutional experience

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## ABSTRACT

**Object.** Our aim is to demonstrate the various aspects of clinical-Radiological presentation and surgical Outcome with association to the tumour size concerning cerebellopontine angle (CPA) tumours.

**Materials and method.** This is a prospective study of 40 patients at the Department of Neurosurgery, Jayarogya Group of Hospitals, GRMC Gwalior, M.P. India. All of the patients were pre-operatively evaluated with either non-enhanced and enhanced computerized tomography (CT) or Magnetic-resonance (MR) imaging or both. CPA tumours (predominantly acoustic neuroma) that underwent surgical removal using a suboccipital retro sigmoid approach over a 2-year period (June 2019 to May 2021).

**Results.** There was a female preponderance. The most common presentation was Sensorineural hearing loss (90%) followed by Headache (67.5%). The majority of cases of Vestibular Schwannoma have heterogenous enhancement with cystic component. 65% of patients have large (26-40mm) size tumours and facial nerve preservation is 86.4% in medium size tumours (10-25 mm). and Incidence of post-operative of facial nerve palsy is more in Giant size tumour (> 40mm) so Positive association between size of lesion and Incidence of Post-operative facial nerve palsy. CSF leak occurs in 6 patients and postoperative Hydrocephalus occur in 2 patients and Mortality occurs in 3 patients.

**Conclusion.** CP angle Tumor was common in middle age group, with the incidence in females slightly more than in males. The majority of lesions were of large size (26-40mm). Most of the patients on admission had a non-serviceable hearing. Heterogeneous enhancement with cystic components was found in most of the lesions. Gross-total excision was one in the majority of cases and vestibular schwannoma was the most common histopathological lesion obtained. Facial nerve palsy was the most complication and as the size of the lesion increased, the possibility of facial nerve palsy also increased post-operatively. Overall mortality is 7.5%.

## INTRODUCTION

CP Angle tumors account for 5-10% of intracranial tumors. [1, 2] Most Cerebello-pontine Angle tumors are benign, with over 85% being vestibular schwannomas (acoustic neuromas). Primary malignancies or metastatic lesions accounting less than 2% of neoplasm in the CPA.

**Keywords**  
cerebellopontine angle  
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tumour size,  
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CT and MRI are widely used radiological methods for cerebello-pontine angle imaging. The main radiological diagnostic goal is the description of the relation of the tumor to IAM, the brainstem and cerebellar hemispheres. The second line basic information is if the lesion is extra-or intracerebral.

The options available for management includes Observation, Surgery, Stereotactic Radiosurgery, Fractionated radiotherapy. Some patients might also be candidates for a combination of these therapies. The ideal treatment is total excision of tumor. Several approaches and techniques are available for the resection of CPA tumors, including trans labyrinthine, retro sigmoid, suboccipital, retro labyrinthine, trans cochlear, transotic and middle fossa approaches. Surgery improves quality of life in patients but each approach is associated with postoperative complications like mortality, hematoma, pneumocephalus, cranial neuropathies, cerebellar dysfunction, brainstem complications, infections, CSF leaks etc.

The Suboccipital retro sigmoid approach is a popular method of excising CPA tumors. Advantages of this approach include a low complication rate, particularly with regard to facial nerve function, and total tumor removal in the vast majority of cases. Moreover, the technique is safe and effective, even with the largest of tumors.

Technical advances in surgery and anesthesia have revolutionized the results of surgery in cerebellopontine angle lesions with reduced mortality and morbidity. Use of intra-operative nerve stimulators and intraoperative evoked potentials have made the resection of the lesions possible along with preservation of cranial nerves.

#### MATERIAL AND METHODS

This is a prospective study of 40 patients at the Department of Neurosurgery Jayarogya group of Hospitals, G.R.M.C. Gwalior, M.P. were carried out and undergoing surgical removal using the suboccipital retro sigmoid approach. All of the patients were pre operatively evaluated with either non-enhanced and enhanced computerized tomography (CT) or Magnetic-resonance (MR) imaging or both. Computed tomography characteristics reviewed included tumor density and homogeneity, presence and type of contrast enhancement and calcifications. MRI examination was performed on different imaging units, using a

field strength ranging between 0.5 and 1.5 tesla. The magnetic resonance (MR) image parameters used for this study included signal homogeneity and intensity (T1-,and T2-weighted images), presence and type of contrast enhancement, calcifications, and lesion margins, characteristic of the tumor on Diffusion weighted (DWI) and Absoluted diffusion coefficient(ADC)sequences. Hearing assessment was done with the help of Puretone audiometry (PTA) analysis pre-operatively in all patients and were divided into serviceable and non-serviceable category. Gardner Robertson hearing classification scale was used. Speech discriminations coreless than 50% and PTA value>50dB were defined as non-serviceable hearing. Fundoscopy was done in all patients with the help of direct ophthalmoscope to assess the papilledema pre-operatively and was graded according to modified Frisen scale. In all patients, radical excision was attempted. Operating microscope was used in every case. The patients were maintained peri-and postoperatively on steroids. Operative data, including surgical approach, extent of removal, morbidity, and mortality, were evaluated. The completeness of tumor removal was assessed intraoperatively and with postoperative CT and MR imaging. Extent of removal was divided into gross total removal, near-total removal and sub-total removal.

#### DISCUSSION

In general CPA tumors are divided in to acoustic and non-acoustic tumors. The main factor under scoring the importance of accurate preoperative diagnosis is the different surgical approach for vestibular schwannomas and the other tumors. There is general agreement that completeness of tumor resection and preservation of the facial nerve are the major neurosurgical goals. An appreciation of the vascular and cranial nerve micro anatomy and the relationships between neurovascular structures and the tumor are essential for achieving optimal surgical results.

In our study majority of patients 21-30yr, 32.5% [Table-1] Females in our study were 57.5% whereas the males were 42.5%. Arismendi G, et al. showed a 2:1 female to male ratio with a median age was 48+/-12. 7years. Faramarz Memari, et al. [3]. showed that the mean age was 49 years and there was a slight male predominance of 55%.Joarder MA,etal. [4] showed the maximum incidence between 30-50yrs

with female predominance of 55%. Maheswararao Y.V.N, et al. [5] showed that the highest incidence of extra axial Cerebo-pontine angle tumors' were found in 51- 60 years age group with 70% being females.

**Table 1.** Distribution of case according to age

Age (yrs)	Total patients	Percentage
0-20	2	5
21-30	4	10
31-40	13	32.5
41-50	11	27.5
51-60	8	20
61-70	2	5

**Table 2.** Distribution of cases according to clinical presentation

Clinical Findings	Vestibular Schwannoma	Meningioma	Epidermoid cyst	Abscess	Total patients	Percentage
Sensorineural Hearing loss	30	3	2	1	36	90
Cerebellar signs	20	2	1	0	23	57.5
Headache	22	3	1	1	27	67.5
Trigeminal dysfunction	15	2	0	0	18	45
Facial Dysfunction	17	2	1	0	19	47.5
Papilloedema	7	3	0	0	11	27.5
Tinnitus	14	2	0	0	16	40
Pyramidal signs	9	1	0	0	10	25
9,10,11 nerve Dysfunction	5	1	0	0	6	15

In our study sensorineural hearing loss was observed in 90% cases, cerebellar signs were present in 57.5% cases, headache was present in 67.5%,trigeminal dysfunction was present in 45%, facial nerve dysfunction was present in 47.5%, papilledema was present in 27.5%, tinnitus was present in 40%,pyramidal signs was present in 25%, 9,10,11 nerve dysfunction was present in 15% [table-

2]. Our Pure tone audiometry results of serviceable hearing were in 22.5% cases and non-serviceable hearing in 77.5% cases[table-3]. Faramarz Memari, et al, & Joarder MA, et al [3,4] showed same results of clinical presentation.

**Table 3.** Distribution of cases according to pure tone audiometry

Class	Vestibular Schwannoma	Meningioma	Epidermoid cyst	Abscess	Total patients	Percentage
I & II (Serviceable)	3	3	2	1	9	22.5
III & IV (Non Serviceable)	28	2	1	0	31	77.5

**Table 4.** Distribution of cases according to size of lesion & anatomical preservation of facial nerve

Size	Total patients	Patients with anatomically preserved facial nerve
Medium (10-25mm)	6	6 (100%)
Large( 26-40mm)	26	22 (84.6%)
Giant ( >40mm)	8	4 (50%)

Our study depicted medium size (10-25mm) tumors in 15%, large size (26-40 mm) in 65%, giant (>40mm) in 20% [table-4]. Faramarz Memari, et al [3] showed the mean tumor size was 24mm, ranging from 35 mm. Joarder MA, et al [4] showed medium size, tumors in 15%, large size in 58%, giant (>40mm) in 27%.

Anatomical preservation of facial nerve was achieved in the present study for large size tumors in 84.6% of the cases and for giant size tumors in 50%. Joarder MA ,et al.[4]showed that preservation of facial nerve was achieved in 75% for large size tumors and in 55% for giant size tumors. In our study anatomical preservation of facial nerve was achieved in 80.6% of vestibular schwannoma cases overall. In a study on VS by Samii and Matthias preservation rate was reported to be 93%, independent of tumour size. In a study on VS by Vijendra K.Jain, et al [6].the preservation of facial nerve was 84.3%.

In our study it is observed that there is a positive association between size of tumor and incidence of

post-operative facial nerve palsy. Post operatively 1 patient developed facial palsy in medium tumors (16.6%), 14 patients developed facial palsy in large tumors (53.8%) and 7 patients developed facial palsy in giant tumors (87.5%) [Table-5]. As the size increases, possibility of facial nerve palsy also increases post-operatively. Joarder MA, et al [3] and Faramarz Memari, et al [3] also depicted a significant correlation between tumor size and facial nerve outcome, with larger tumors yielding worse outcomes.

**Table 5.** Distribution of cases according to size of lesion & incidence of post-operative facial nerve palsy

Size	Total Patients	Facial nerve palsy
Medium (10-25mm)	6	1 (16.6%)
Large (26-40 mm)	26	14 (53.8%)
Giant (>40mm)	8	7 (87.5%)

**Table 6.** Distribution of cases according to facial nerve Functional grading (post-operative) in already involved facial nerve on admission)

Grade	Pre-op (19)	Post-op (19)			Follow-up (6 month) (16)		
		2	3 & 4	5 & 6	2	3 & 4	5 & 6
2	16	8	6	2	7	4	2
3 & 4	3	0	0	3	0	1	2
5 & 6	0	0	0	0	0	0	0

Our study showed 19 patients have pre-operative facial palsy in which 16 have grade 2, and 3 have grade 3 & 4. Out of 16 patients of grade 2, 6 patients increase to grade 3 & 4 and 2 patient increase to grade 5 & 6. Out of 3 patients of grade 3 & 4, 3 patient increase to grade 5 & 6 [Table-6]. Samii M, et al. [8] showed postoperative grade 1 & 2 facial nerve function in 64% cases, grade 3 & 4 in 21% cases and grade 5 & 6 in 15% cases.

Our study on radiological examinations in vestibular schwannoma showed homogenous enhancement in 2 cases, heterogenous enhancement in 29 cases, cystic component in 29 cases, hyperostosis not found in any radiological imaging. In meningioma, 5 cases had homogenous enhancement and 2 cases had hyperostosis, none had cystic component. In epidermoid cyst, none case had heterogenous enhancement and one case had cystic component, whereas in abscess the only case

had heterogenous enhancement with cystic component [Table-7]. In the study of Maheswara rao Y.V.N, et al [5].

**Table 7.** Distribution of cases according to finding on imaging

Imaging finding (MRI)	Vestibular Schwannoma (31)	Meningioma (5)	Epidermoid cyst (3)	Abscess (1)
Homogenous enhancement	2	5	0	0
Heterogenous enhancement	29	0	1	1
Cystic Component	29	0	1	1
Centered of IAM	27	1	0	0
Broad base dural tail	0	5	0	0

**Table 8.** Distribution of cases according to resectability

Tumor	Gross Total Excision	Near-Total Excision	Sub-Total Excision
Vestibular Schwannoma (31)	26 (84%)	3 (10%)	2 (6%)
Meningioma (5)	4 (80%)	1 (20%)	0 (0%)
Epidermoid (3)	2 (67%)	1 (33%)	0 (0%)
Abscess (1)	1 (100%)	0 (0%)	0 (0%)

We performed VP-shunt followed by definite surgery in 25% cases and direct tumor surgery in 75% cases.

In our study, in vestibular schwannoma we did gross total excision in 84% cases, near-total in 10% and sub-total in 6% cases. In meningiomas we had gross total excision in 80%, near-total in 20%. In epidermoid we had 67% gross-total excision and 33% near total excision. Whereas in abscess we had gross total excision in 100% of cases [Table-8]. Overall gross total resection done in 33 patients (82.5%) and near-total resection in 5 patients (12.5%) and sub-total resection in 2 patients (5%).

In all the 40 cases, operation was done by sub-occipital retro-mastoid approach in semi-sitting position and in none of the cases we found any position related clinically apparent complication

(intra-operative and postoperative). IAC drilling was done in all cases of VS (31 cases). Faramarz Memari, et al. [3] in a study on CP-angle lesions, achieved complete gross tumor removal in 92% of patients. In study done by Sourabh Dixit, et al [10] on VS, the gross total resection was done in 84.61% cases and subtotal done in 15.38% cases.

In our study, in histopathology, vestibular schwannoma accounted for 77.5% cases, meningioma for 12.5%, epidermoid cyst for 7.5% and abscess for 2.5%.

Our study showed CSF leak in 15% cases over all. All were initially managed conservatively with lumbar drain and medication. Meningitis occurred in 10% cases in which two patients recovered with appropriate antibiotics whereas rest of the two patients who also had simultaneous CSF leak, deteriorated and expired. Faramarz Memari, et al [3]. in CP-angle cases had rates of CSF leakage for retro-sigmoid approach around 18% and meningitis in 10% cases.

In our study lower cranial nerves palsy was seen in 20% cases (6 deteriorated cases + 2 new onset cases) and they were managed with nasogastric tube feeding. At 6 months follow up 2 patients showed incomplete recovery of lower cranial nerves palsy. We observed, in VS subgroup, facial nerve palsy in 47.5% cases and lower cranial nerve palsy in 22.5% cases. Vijendra K. Jain, et al [6] in their study on VS had the incidence of lower cranial nerve paresis of 6.8%. Sourabh Dixit, et al [10] in their study on VS had transient lower cranial nerve paresis in 46.15% patients which gradually improved. The reported incidence of lower cranial nerve paresis in the rest of literature ranges from 1.5% to 5.5%.

In our study pre-operatively, 77.5% of cerebello-pontine angle tumor patients had no useful hearing (>50 decibels). Out of the 9 patients (3 Vestibular Schwannomas, 3 meningiomas, 2 epidermoid cyst, 1 abscess) who had useful hearing preoperatively, 3 patients (2 epidermoid cyst and 1 abscess patient) retained it postoperatively also making our overall hearing preservation upto 33.3%. In VS sub-group hearing preservation was 0%. Hearing status of all the patients at 6 months follow up remained same as that of post-operative period. Samii, et al [8]. in their study on VS, reported hearing preservation in 23.6% with large tumors. Vijendra K. Jain, et al [6]. in their study on VS, reported hearing preservation in 29.6% of their

patients who had useful pre-operative hearing.

In our study, follow up of 37 patients showed recurrence in two patients (5%) (one vestibular schwannoma and one meningioma) and were managed conservatively as both the patients were not ready for re-operation or SRS referral. Faramarz Memari, et al. [3] in their study on CP angle lesions, had residual tumor in 7% for retro sigmoid approach. In our study, in VS subgroup we had 3.22% recurrence. Gormley and Sekhar, et al [7] in their study on VS, reported complete tumor resection was accomplished in 99% of the patients, and there was no evidence of recurrence in this group. Vijendra K. Jain, et al. [6] in their study on VS, had achieved complete tumor excision in 96.5%.

In our study overall mortality was seen in 7.5% cases mainly attributable to post-operative CSF leak and meningitis. Faramarz Memari, et al [3] in their study on CP angle lesions, had mortality of 2% for retro-sigmoid approach. mortality in their series of VS.

## CONCLUSION

CP angle SOL was common in middle age group, with incidence in females slightly more than males. Decreased hearing and cerebellar symptoms were the most common complaints. Majority of lesions were of large size (26-40mm). Most of the patients on admission had non-serviceable hearing. Heterogenous enhancement with cystic component was found in most of the lesions. Gross-total excision was done in majority of cases and vestibular schwannoma was the most common histopathological lesion obtained. Facial nerve palsy was the most complication and as the size of lesion increased, possibility of facial nerve palsy also increased post-operatively. Overall mortality was in 7.5% cases, mainly due to post-operative meningitis and CSF leak.

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