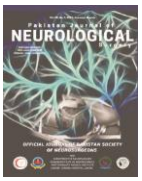

PAKISTAN JOURNAL OF NEUROLOGICAL SURGERY (QUARTERLY) – OFFICIAL JOURNAL OF PAKISTAN SOCIETY OF NEUROSURGEONS

Original Article

Post-operative Status of Facial Nerve in Cerebello-Pontine Angle Lesion via Retro-Sigmoid Approach; Complications and Outcome

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ABSTRACT

Objective: To assess the post-operative status of Facial Nerve in cerebellopontine angle (CPA) lesion via retro-sigmoid approach and also its complications and outcome.

Materials & Methods: This prospective study was conducted at the Department of Neurosurgery, JPMC Karachi from a period of 10-12-2021 to 10-06-2022.The sample size of our study was 37 patients. All the patients were operated for CPA lesions and followed for three months to assess the outcome efficacy.

Results: Our study showed that the mean age was 37 years, with a range of 27 to 65 years, in which the males were 18 (48.6%) and the females were 19 (51.4%). Out of 37 patients, 28 (75.7%) were diagnosed with vestibular schwannoma, while 6 (16.2%) were meningiomas, and 3 (8.1%) were epidermoid cysts. Gross total resection was performed in 14 (37.8%) patients, while subtotal resection (STR) in 23 (62.2%). Facial nerve function in terms of House-Brackmann at 3 months was found to be grade I in 26 (70.3%), grade II in 9 (24.3%), grade III in 1 (2.7%), and grade IV in 1 (2.7%).

Conclusion: The CPA is a small corridor through which important neurovascular structures pass. Identification of CN VII is important in large CPA tumours to preserve facial motor nerve function. For all kinds of CPA lesions, gross total excision should be the aim of surgery.

Keywords: Facial Nerve, House-Brackmann Grade, Cerebello-Pontine Angle, Retro-Sigmoid Approach.

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Date of Submission: 15-08-2022
Date of Revision: 20-09-2022
Date of Acceptance: 23-09-2022
Date of Online Publishing: 30-9-2022
Date of Print: 30-9-2022

DOI: 10.36552/pjns.v26i3.785

INTRODUCTION

The cerebellopontine angle, often known as the CPA, is a triangular region that can be found in the posterior fossa of the skull. It is bordered superiorly by the tentorium, postero-medially by the brainstem, and postero-laterally by the petrous part of the temporal bone. The CPA cistern is a significant anatomical and clinical landmark because it contains the cranial nerves V, VI, VII, and VIII in addition to the anterior inferior cerebellar artery. The most frequent location for

posterior fossa neoplasms is the Cerebellopontine Angle (CPA).[1]

The lesions of CPA make up around ten percent of all intracranial neoplasms, with vestibular schwannoma being responsible for eighty percent of these lesions. Meningioma is the second most common tumour in CPA that contributes 5 – 15% of this area. Other common tumours in this area are epidermoid cysts and arachnoid cysts.[2]

Vestibular schwannomas are benign tumours that develop from the Schwann cells that are found in the vestibular branch of the vestibulocochlear nerve. Using contemporary imaging methods such as magnetic resonance imaging (MRI) and computed tomography (CT), vestibular schwannomas can be detected radiologically in their early stages.[3]

The objective of surgery for vestibular schwannoma has evolved from extending the patient's life to preserving nerve function, thanks to recent advancements in neuroimaging and microsurgical techniques. Surgical treatment for vestibular schwannomas should aim to excise the tumour completely while preserving the facial nerve and if at all possible, the patient's hearing. This should be the ultimate objective of treatment for vestibular schwannomas. However, surgery for large schwannomas is still a significant challenge because complete excision of the tumour carries a significant risk of injuring adjacent vital brain structures and also the facial nerve.

The severity of the injury to the facial nerve was measured using the House-Brackmann Grade (HBG), with grade I representing normal function, grade II representing mild dysfunction, grade III representing moderate dysfunction, grade IV representing moderately severe dysfunction, grade V representing severe dysfunction, and grade VI representing total paralysis of the facial nerve.[4] When it comes to tumours affecting the facial nerve, vestibular schwannomas are by far the most frequent. Other tumours that affect the facial nerve are meningioma and epidermoid cysts. Most CPA lesions are operated via a retro-sigmoid, translabyrinthine, suboccipital approach. Other options include Gamma knife Radiosurgery.

We carried out a comprehensive study that reported CP angle lesions, with a particular emphasis on facial nerve outcomes as a function of surgical procedures and the extent to which tumours were removed.

MATERIALS AND METHODS

Study Design and Setting

This is a prospective study conducted from 10-12-2021 to 10-06-2022, at the department of Neurosurgery, Jinnah Postgraduate Medical Centre, Karachi.

Inclusion Criteria

We included 37 adult patients who were operated on via the retro-sigmoid approach for a CPA lesion and had a pre-operative House-Brackmann Grade ≤ 2 for facial nerve function.

Exclusion Criteria

Facial nerve dysfunction (House-Brackmann Grade 3 or above), and the patient who underwent surgery previously and recurrent disease and size of tumour < 2 cm were excluded.

Data Collection Procedure

All patients were followed for 3 months after the surgery and data regarding age, gender, initial symptoms, pre-operative neurological status, intra-operative tumour features, early post-operative neurological status, and complications were all gathered. Due to unavailability, no intraoperative facial monitoring was used for any patient in our study. Both immediate post-operative and follow-up facial nerve function at 3 months were recorded using the House–Brackman grading. The outcome in our patients was defined as any change in facial nerve function

at 3 months follow-up and categorised as "Remain same", "Improve" and "Worse".

Data Analysis

Data was analysed through SPSS to calculate mean, frequencies, and p values. A p-value of less than 0.05 was taken as significant in our study.

RESULTS

Age & Gender

Our study showed that the mean age was 37 years, with a range of 27 to 65 years, in which the males were 18 (48.6%) and the females were 19 (51.4%) given in Table 1.

Diagnosis

Out of 37 patients, 28 (75.7%) were diagnosed with vestibular schwannoma, while 6 (16.2%) were meningiomas, and 3 (8.1%) were epidermoid cysts.

Clinical Symptoms

The common symptoms in our patients were vomiting 19 (51.4%) followed by headache 32 (86.5%), gait disturbance 29 (78.4%) and hearing loss 30 (81.1%). Hearing loss was incomplete in 26 (70.3%) and complete hearing loss in 4 (10.8%). The incidence of hydrocephalus associated with CPA lesions in our study was 83.8% (31 patients).

Pre-operative House Brackmann Grade I was observed in 20 (54.1%) patients and Grade II in 17 (45.9%).

Table 1: General characteristics and frequencies of patients.

S. No.	Category	Sub-Category	Number (n)	Percentage (%)
1.	Gender	Male	18	48.6
		Female	19	51.4
2.	Diagnosis	Vestibular schwannoma	28	75.7
		Meningioma	06	16.2
		Epidermoid cyst	03	8.1
3.	Symptoms	Vomiting	19	51.4
		Hearing loss	30	81.1
		Incomplete	26	70.3
		Complete	4	10.8
		Gait disturbance	29	78.4
		Headache	32	86.5
4.	Pre-Operative HBG	Grade I	20	54.1
		Grade II	17	45.9
5.	Hydrocephalus		31	83.8
6.	Size of Tumour	2.5-3.5cm	7	18.9
		3.5-4.5cm	14	37.8
		More than 4.5	16	43.2
7.	Immediate Post-Operative HBG	Grade I	20	54.1
		Grade II	8	21.6
		Grade III	2	5.4
		Grade IV	3	8.1
		Grade V	2	5.4
		Grade VI	2	5.4
8.	Surgical Resection	Gross Total	14	37.8
		Sub- Total	23	62.2
9.	3-month follow-up Post-Operative HBG	Grade I	23	62.2
		Grade II	9	24.3
		Grade III	1	2.7
		Grade IV	1	2.7
		Grade V	2	5.4
		Grade VI	1	2.7
10.	Outcome	Remain Same	18	48.6
		Improve	08	21.6
		Worse	11	29.7

Size of Lesion

The size of the lesion was calculated on the MRI and it showed that the size of 2.5 – 3.5 cm was observed in 7 (18.9%) patients, the size of 3.5 – 4.5 cm was observed in 14 (37.8%) patients, and the size of > 4.5 cm was observed in 16 (43.2%) patients.

Surgery

We operated on all 37 patients via a retro-sigmoid approach, in which gross total resection (GTR) was performed in 14 (37.8%), while subtotal resection (STR) was performed in 23 (62.2%) patients.

Post-operative Facial Nerve Status

Immediate postoperative facial nerve function was assessed, which showed that grade I was found in 20 (54.1%), grade II in 8 (21.6%), grade III in 2 (5.4%), grade IV in 3 (8.1%) and grade V in 2 (5.4%), grade VI 2 (5.4%).

Facial nerve function was also assessed again at 3-month follow-up and we found that grade I in 23 (62.2%), grade II in 9 (24.3%), grade III in 1 (2.7%), and grade IV in 1 (2.7%), grade V 2 (5.4%), grade VI 1 (2.7%).

Complication

In our study, four patients developed CSF to leak out of which the leak stopped in three patients after shunt revision, while one developed pseudomeningocele and needed re-exploration, and two developed hematomas, in which one patient re-explored for hematoma evacuation.

Comparison

We compared the pre-operative House-Brackman grade with the immediate post-operative House-Brackman grade and found that the P value was insignificant (0.562). When we compared the pre-operative House-Brackman grade with the 3-month follow-up post-operative House-Brackman grade and found that the P value was insignificant (0.313) as shown in table 2.

But when we compared the immediate post-operative House-Brackman grade with the 3-month follow-up post-operative House-Brackman grade, a significant relationship was noted (P value 0.000) as shown in Table 3.

We compared the outcome with the gender and found that there is no significant relationship

Table 2: Cross table showing a comparison between Pre-operative House Brackmann Grades with the 3 Months Post-operative House Brackmann Grades.

Pre-Operative House Brackmann Grades	3 Months Post-Operative House Brackmann Grades						Total	P Value
	Grade I	Grade II	Grade III	Grade IV	Grade V	Grade VI		
Grade I	15	3	0	0	1	1	20	
Grade II	08	6	1	1	1	0	17	0.313
Total	23	09	1	1	2	1	37	

Table 3: Cross table showing a comparison between Immediate Post-operative House Brackmann Grades with the 3months Post-operative House Brackmann Grades.

Immediate Post-Operative House Brackmann Grades	3 Months Post-Operative House Brackmann Grades						Total	P Value
	Grade I	Grade II	Grade III	Grade IV	Grade V	Grade VI		
Grade I	20	2	1	0	0	0	23	
Grade II	00	6	1	2	0	0	9	
Grade III	0	0	0	0	1	0	1	0.000
Grade IV	0	0	0	1	0	0	1	(significant
Grade V	0	0	0	0	1	1	2	result)
Grade I	0	0	0	0	0	1	1	
Total	23	09	1	1	2	1	37	

Table 4: Cross table showing a comparison between outcome with the Pre-Operative House Brackmann, size of the tumour and surgical resection.

Parameters		Outcome			P Value
		Remain Same	Improve	Worse	
Pre-Operative HBG	Grade I	14	0	6	0.001 (significant result)
	Grade II	4	8	5	
Size of Tumour	2.5-3.5cm	6	1	0	0.054
	3.5-4.5cm	3	5	6	
	More than 4.5 cm	9	2	5	
Surgical Resection	Gross Total	6	4	4	0.716
	Sub- Total	12	4	7	

seen (P values 0.335). It was also noted that the kind of diagnosis did not exhibit any meaningful association with the result. This was another finding that was made (P value 0.394). In the research that we conducted, we discovered that the pre-operative House-Brackman grade showed a meaningful correlation with the final result (P value 0.001). We also compared the size of the tumour with the outcome and found that their P value (0.054) is insignificant. But when we compared the outcome with the resection, it found that there is no significant relationship (P value 0.71) as shown in table 4.

DISCUSSION

CPA lesions account for around ten percent of all intracranial neoplasms, with vestibular schwannoma accounting for the majority of these lesions. Meningioma is the second most common tumour, and others are epidermoid cysts and arachnoid cysts.[2]

Patients in our study were found to be younger than the majority of published literature. In the course of our research, we determined that the average age was 45 years old, with the ages ranging anywhere from 27 to 65. The mean age in a study conducted by Nakamura et al, was 53.4 years (range 17.6 – 84 years), while another study by Jagdeep Singh Virk et al, showed a mean age of 48.3 years (range 22 – 78).[5,6]

In our study, both genders were almost equally presented with CPA lesions and a male: female ratio of 1:1.05. Literature shows varying distributions. One study had a Male: Female distribution of 1:8 while another study showed a male to female distribution of 1:1.[5,6]

In our study, the most common presenting symptoms were headache (86.5%), followed by hearing loss (81.1%), gait disturbance (78.4%) and vomiting (51.4%). One study from the literature shows that hearing loss (68.7%) was the commonest symptom followed by headaches were reported by 6.1% of patients.[7,8] Hearing loss in our studied patients was distributed as complete hearing loss in 13.3% of patients and incomplete hearing loss in 86.7% of patients.

Most of the patients with CPA lesions developed hydrocephalus (83.8%). while Gerganov VM et al, study that 13% of their patients had hydrocephalus.[13]

In our study, we only included patients who had preoperative House Brackmann Grade I or Grade II. Grade I was observed in 20 (54.1%) patients and Grade II in 17(45.9%). In a study by Gerganov et al, preoperative House-Brackmann Grade I was 93%, while Grade II-III was 4%.[7] Bethelehem et al, also reported in their study that most of their patients had pre-operative House Brackmann Grade I and II.[9]

In our study, we compared the size of the lesion with the House Brackmann Grading. The

size of the lesion was calculated on the MRI and it showed that a tumour of size 2.5 – 3.5 cm had HBG Grade I and a size of 3.5 – 4.5 cm mostly had HBG Grade I and II, and size of > 4.5 cm had grade I, II, III, and IV. A published study by Memari, Faramarz et al, also compared the size of the lesion with House-Brackmann Grade and showed that the average size of the tumour is 1 – 15mm having House-Brackmann Grade I and II. The tumour has a size of 16 – 35mm mostly in House Brackmann Grade I, II, III, and IV. The tumour has a size greater than 35mm, mostly having Grade IV, V, and VI.[10]

Patients diagnosed with CPA operated via retro-sigmoid approach, in which most patients underwent subtotal resection (STR) 23 (62.2%). while in other literature most patients underwent gross-total resection (GTR) and 15.8% of patients operated via a subtotal resection.[11,12]

In our study, patients operated for CPA lesions, we assessed the facial nerve function immediately after surgery, which showed that most patients had Grade I (54.1%), while 21.6% patients had Grade II, 5.4% Grade III, 8.1% Grade IV, 5.4% Grade V and 5.4% Grade VI. The facial nerve function was again assessed at 3 months follow up and found that there was an improvement in some patients now the patients had grade I at 62.2%, grade II at 24.3%, grade III at 2.7%, grade IV at 2.7%, grade V 5.4% and grade VI 2.7%. While Jagdeep Singh Virk et al, reported postoperative facial nerve function in their study and which showed that 69% had HBG I/II and 31% were HBG V/VI.[6] while a study by Gerganov VM et al, in a published study, showed that most patients have Grade I (53%), and Grade II-III (25%), while another grade has also seen when they asses postoperatively.[7]

In our study, four patients developed CSF to leak out of which leak stopped in three patients after shunt revision, while one patient developed pseudomeningocele and needed re-exploration. After surgery, two patients developed a hematoma and one patient needed re-exploration. A published study by Nakamura et al, reports that 12 patients develop post-operative intracerebral haematoma in which nine patients were re-explored.[5] In another literature nine patients develop CSF leaks in which four patients were managed via different surgical technique.[10]

In our study, when we compared the outcome with the degree of resection, we found that there is no relationship (P value 0.71) while Gurgel RK et al, in their study showed that there was a strong and significant association between the degree of resection and outcome (P value 0.0001).[14]

When treating a patient with a CPA lesion, the objective of surgery is to completely remove the tumour while preserving the function of as many cranial nerves as possible. Facial nerve palsy is the most important troublesome problem after the excision of the CPA lesion. The most important factors that influence facial nerve function include the surgeon's experience, the extent of resection, and the selected approach. However, large tumours continue to provide clinical challenges since they are associated with a poorer prognosis than smaller tumours, particularly concerning the function of the facial nerve. For CPA lesions, numerous techniques are used including the retrosigmoid transmeatal approach, the translabyrinthine route, the middle cranial fossa method, and the combination technique.

CONCLUSION

The CPA is a small corridor through which important neurovascular structures pass. Identification of CN VII is important in large CPA tumours to preserve facial motor nerve function. The normal anatomy may be distorted as the tumours grow in size, causing the complication to identify and preserve normal anatomy after excision. For large CPA tumours, the goal of surgery is Gross total resection with the preservation of the facial nerve via a retrosigmoid transmeatal approach involving intraoperative

facial nerve monitoring. Subtotal resection is recommended in patients having large CPA lesions with significant adhesion with vital neurovascular structures, to protect the facial nerve.

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Additional Information

Disclosures: Authors report no conflict of interest.
Ethical Review Board Approval: The study conformed to the ethical review board requirements.
Human Subjects: Consent was obtained by all patients/participants in this study.
Conflicts of Interest:
In compliance with the ICMJE uniform disclosure form, all authors declare the following:
Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.
Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Anas Ahmed	1. Study design and methodology.
2.	Farrukh Javeed	2. Paper writing.
3.	Yousra Hatif	3. Data collection and calculations.
4.	Sehrish Altaf	4. Analysis of data and interpretation of results.
5.	Sagheer Ahmed	5. Literature review and referencing.
6.	Lal Rehman	6. Editing and quality insurer.