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Surgical Management of Cerbellopontine Angle Tumors - Experience from a Tertiary Care Hospital of Peshawar

Mumtaz Ali, Akram Ullah, Ramzan Hussain, Hamzullah Khan, Sajid Khan

ABSTRACT

Objectives: to determine the surgical outcome (clinical improvement and surgical excision) of CP angle tumors and its management in a hospital based study.

Study design and setting: This descriptive case series study was carried out in the Department of Neurosurgery Prime Teaching hospital Peshawar from Jan 2018 to 30th August 2022.

Methodology: All patients with CP angle disorders were included in the study irrespective of age and gender. Patients with pineal tumor and posterior fossa abscess were excluded.

Results: A total of 48 patients were enrolled with 26(54.2%) males and 22(45.8%) females. The mean age with standard deviation of patients was 42+ 9 years. The frequency of CP angle disorders were; Vestibular Schwannoma (Acoustic Neuroma) 31(64.6%), CP Angle Meningioma 8 (16.7%), Vestibular Schwannoma with Hydrocephalus 6(12.5%) and Epidermoid cyst 3(6.3%). 39(81.3%) of the patients were managed through Microsurgical Retrosigmoid Craniectomy, 6(12.5%) via Ventriculo-Peritoneal Shunt and 3(6.3%) were conservatively managed. Eight patients were expired during the follow up. The mean size of tumor was 3.2cm. There was no statistically significant association of gender and age with outcome/mortality in CP angle pathologies *(p-0.195, 0.219* respectively*)*. In 11 cases post-operative complications were recorded. 6(12.5%) cases were reported with facial Nerve palsy.

Conclusion: Vestibular Schwannoma (Acoustic Neuroma), CP Angle Meningioma, and Vestibular Schwannoma with Hydrocephalus are most common CP Angle pathologies in our set upThere is no statistically significant association of morbidity and mortality of CP angle tumors with age and gender. Facial nerve palsy was well managed with facial hypoglossal anastomosis and torsorraphy.

Key words: CP angle tumors, Vestibular Schwannoma, CP angle meningioma, Craniectomy, VP-shunting, mortality.

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INTRODUCTION:

Cerebellopontine angle is a triangular space which is bounded antero-medially by pons, laterally by petrous part of temporal bone and posterior-medially by cerebellum. Approximately 10% of the total intracranial tumors are reported in CP angle region.[1] Vestibular shwanoma or acoustic neuroma is the most common cerebellopontine (CP) angle tumor and accounts for more than 90% of the total CP angle pathologies[2]. Other lesion/tumors of the CP angle are Meningioma, facial Nerve shwanoma and primary cholestoma[3].

Mostly these tumors are benign tumor and undergo asymptomatic phase for longer time and whether or not to operate on these tumors depends largely on the size of tumor, compression symptoms , age of patients, willingness for surgery and extension of the tumor in the CP angle. However the management of CP angle tumor is primarily surgical though surgical resection except for the tumors which are less than 2.5cm in size with no neurological deficit[4]. For such type of tumors with size less than 2cm, aged patients or unwilling for surgery patients the wait and see policy with microsurgical resection or radiosurgery using gamma knife techniques are the best choice. Ventriculoperoitoneal

shunt alone can reduce the compression symtoms[5]. But the goals of all the interventions is complete tumor resection with preservation of hearing, facial nerve injury, corneal injury and other peri-operative complaications[6].

The decision on plan of management of CP angle tumor is a team work is more challenging in order to avoid the intra-operative and post-operative complications/insult to cranial nerves and other vital anatomical structures.

The Most commonly reported complications post-operatively in CP angle tumpors are facial nerve palsies, exposure karatitis , Corneal opacities etc. Bells Phenomenon is commonly seen after an insult/trauma to facial Nerve during the CP angle tumor surgeries. . The abducent nerve (VI) is affected by large vestibular shwannoma followed by an increased intracranial pressure with damge to CN-VI intra-operatively or due to trauma causing exposure keratitis[8,16]. Studies haves reported to have managed such cases conservatively while 40-45% of the comlications required surgeries to manage, [9,16]

Vestibular Schwannoma with Hydrocephalus are managed with Ventriculo-Peritoneal Shunt. Obstructive hydrocephalus with acoustic neuroma as result of compression of 4th ventricle by the CP anlgle tumor. This hydrocephalus usually subsides in majority of the cases with removal of the tumor and decompression but some cases require permanent cerebrospinal fluid diversion with VP shunting due to persistent raised pressure [10,20]

Meningioma occupying the CP-angle region may present with different origins. Such like meningioma surrounding the vital tissues make it difficult for the neurosurgeon to determine whether the surgical excision is favored or to go for conservative management using gamma knife radio-surgery depending on the neuro-deficit and size of the tumor[7].

Patients with CP angle tumors with upper age limites i.e above 60 year of age or those not willing for surgery or in cases the tumor size was less than 2cm with no neurological deficit are usually managed through modern technologies of gamma knife surgery[7].

Present study was therefore designed with the objectives to determine the surgical outcome of CP angle tumors and its management under the impact of age and gender in a hospital based study

METHODOLOGY:

This descriptive case series study was carried out in the Department of Neurosurgery Prime Teaching hospital Peshawar from Jan 2018 to 30th August 2022. All patients with cerebellopontine (CP) angle disorders were included in the study irrespective of age and gender.

The study was approved by the Ethical review committee of the institution Prime Teaching Hospital 11/ERC/PTH Dated 20-6-2022. All the patients underwent complete neurological examination before and after the surgery. Pre-operative pure tone audiometry was done for all patients with acoustic neuroma to assess the hearing loss degree.

The tumor size was assessed using MRI brain with and without contrast to find out lesion on the CP angle to decide for surgery. The size of tumor was taken in centime in largest vertical diameter. Hydrocephalus was assessed pre and post –op cases by neuroimaging study.

All patients were operated through sub-occipetal reteromastoid craniectomy using microsurgical techniques. All the patients underwent the microsurgical reterosgmoide craniectomy in lateral position with head flexed anteriorly and rotated contralaterally with lateral flexion. Decompression was done under multimodality monitoring in standard manner. Tumor were removed completely with preservation of neurovascular structures and functions. Facial never functions were assessed post-operatively using House–Brackmann scale and characterized good, fair and poor performance with HB I-VI. Hydrocephalus was assessed with the ratio of maximal width of frontal horn with inner table of cranium at the same level. Obstructive HCP was defined by a disproportionally small fourth ventricle in relation to the lateral and third ventricles. Indication of VP-shunting was based on tumor swelling with hydrocephalus, papilloedema and worsening of facial functioning.

The data was entered in SPSS version 25. The quantitative variables were measured with mean and standard deviation. The categorical variables were presented in frequency with percentages. The relationship of age and gender with outcome and CP angle pathology was assessed using chi-square test. A p-values of less than 0.05 was taken as significant.

RESULTS:

A total of 48 patients were enrolled the mean age with standard deviation of patients was 42+ 9 years. The age range was from minimum of 15 years to a maximum of 69 years . There were 26(54.2%) males and 22(45.8%) females (Table 1a).

The frequency of CP angle disorders were; Vestibular Schwannoma (Acoustic Neuroma) 31(64.6%), CP Angle Meningioma 8 (16.7%), Vestibular Schwannoma with Hydrocephalus 6(12.5%) and Epidermoid cyst 3(6.3%). (Table 1b)

Thirty nine(81.3%) of the patients were managed through microsurgical Retrosigmoid Craniectomy, 6(12.5%) via Ventriculo-Peritoneal Shunt and 3(6.3%) were conservatively managed (Table 1c). Eight patients were expired during the follow up period (Table 1d).

There was no statistically significant association of gender and age with outcome/mortality in CP angle pathologies *(p-0.195, p=0.219)* besides that a higher proportion of deaths were recorded in male gender without reaching a statistical significance.(Table 2a &b)

In 11 cases post-operative complications were recorded.

6(12.5%) cases developed facial Nerve palsies that was managed successfully with facial hypoglossal anastomosis. Two cases (4.2%) developed post-op exposure karatitis that was successfully managed with torsorrhaphy and two cases had Brainstem contusion with hemeperisis. (Table 3)

One of such case underwent per-cutaneous endoscopic gastrostomy (PEG procedure) in gastroenterology unit of the same hospital because as per protocol of the unit and gastoentrology guidelines, for the nutritional support . Three(6.3%) of the cases were managed conservatively, one case was at 69 year of age and was not willing for surgery and in 2(4%) cases the tumor size was less than 2cm with no neurological deficit and were advised gamma knife surgery. Similarly due to limited cases we could not reached a significance level to determine the association of different CP angle Pathologies with mortality *(p-0.334).*

We could not find a significant association of different CP angle Pathologies with mortality *(p-0.334)* in present study.

The treatment of CP angle tumor with size more than 3cm were only operated while the patients with less than 3cm were referred for radio-surgery (gamma knife surgery).

Figure 1 & 2 shows pre-op and post op CP angle tumors (Meningioma and Vestibular Shwanoma)

Table 1. Descriptive Statistics of Gender, CP Angle Pathologies and management

a. Gender distribution		
Gender	Frequency	Percent
Male	26	54.2
Female	22	45.8
Total	48	100.0
b. Frequency of CP Angle Pathologies		
CP Angle Pathologies	Frequency	Percent
Vestibular Schwannoma	31	64.6
CP Angle Meningioma	8	16.7
Vestibular Schwannoma with Hydrocephalus	6	12.5
Epidermoid cyst	3	6.3
Total	48	100.0
c. Management/Procedure of CP Angle Pathologies		
Microsurgical retrosigmoid Craniectomy	**39**	**81.3**
Ventriculo-Peritoneal Shunting	**6**	**12.5**
Conservative Management / referral for Gamma knife Radiosurgery	**3**	**6.3**
Total	**48**	**100**
d. Outcome of patients with CP Angle Pathologies		
Discharged	40	83.3
Expired	8	16.7
Total	48	100.0

Table 2a. Association of gender with Outcome in CP angle pathologies

		Outcome		Total	Sig
		Discharged	Expired		
gender	Male	20	6	26	0.195
	Female	20	2	22	
Total		40	8	48	

Table 2b. Association of age with Outcome in CP angle pathologies

		Outcome		Total	Sig
		Discharged	Expired		
age categories	age<18y	1	0	1	0.219
	19-35 y	6	1	9	
	36-55 y	29	5	32	
	>55 y	4	2	6	
Total		40	40	8	48

Table 3a. Complications of Surgeries to explore CP Angle

Complications	Frequency	Percent
Facial Nerve Palsy	6	12.5
Exposure karatitis/corneal opacity	2	4.2
Respiratory stress followed with tracheostomy	1	2.1
Brainstem contusion with hemeperisis (post-traumatic)	2	4.2
No complication	37	77.1
Total	48	100

Table 3b. Management of CP Angle tumors

Management	Frequency	Percent
Facial hypoglossal anastomosis	5	10.4
Torsorrhapy	2	4.2
Per-cutaneous endoscopic gastrostomy (PEG)	1	2.1
Re-exploration	2	4.2
Total	10	20.8
Total patients	48	100

Figure 1: Pre-operatory images of Meningioma and Vestibular shwanoma

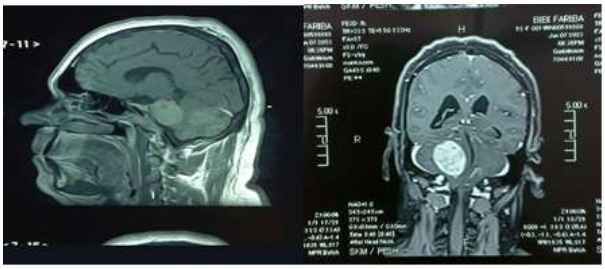
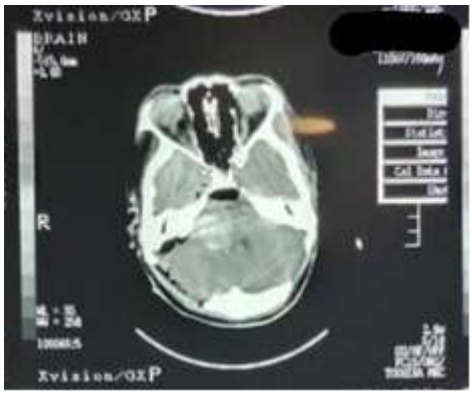


Figure 2: Post-op vestibular shwanoma



DISCUSSION:

There has been a considerable achievements in the field of neurosurgery for the management of the CP angle tumors specially the nestibular shwannoma. Complete excision of tumor without mortality was reported in 1964-65 era using operating microscope, with safe anesthesia and refined microsurgical instruments and techniques with shifting from the complete resection of tumor to the preservation of facial and cochlear nerve functions during the surgical procedure by Rand and cruze[8.]

In present study we also observed that Vestibular Schwannoma (Acoustic Neuroma) 31(64.6%), CP Angle Meningioma 8 (16.7%), Vestibular Schwannoma with Hydrocephalus 6(12.5%). Our findings are in concordance with the findings of other studies [9-11.] . These are typically benign tumors that arise from the divisions of the VIII cranial nerve or vestibule-cochlear nerve. As these tumors arise in size these interfere with the surrounding structures and causing disturbance of vital functions like swallowing, hearing, balance, facial movements and sensational issues,[10,11]. We noted 6(12.5%) cases developed facial Nerve palsies that was managed successfully with facial hypoglossal anastomosis in 4 (8%) cases the facial palsy was not due to surgical reason rather it was a post-traumatic effect. Harati A et al[10] reported 12% of the study cases had facial nerve dysfunction, including moderate palsy (HB Grade II-III) in 4 patients and hemifacial spasm in 2 individuals that was matching with our findings. Rutong YU et al[1] Reported facial hypoesthesia-numbness in (20.56%) cases. Management and preservation of facial nerve is challenge for the neurosurgeon. We managed in 4 (8%) cases successfully with facial hypoglossal anastomosis while in 2 patients the symptoms subsided gradually with time. This is widely acceptable procedure for the FN repair in CP angle tumors and has been documented a lot[12-14]. Two cases (4.2%) developed post-op exposure karatitis that was successfully managed with torsorrhaphy. Corneal opacities or Bells Phenomenon is commonly seen after an insult/trauma to facial Nerve during the CP angle tumor surgeries. . The abducent nerve (VI) is affected by large vestibular shwannoma followed by an increased intracranial pressure with damge to CN-VI intra-operatively or due to trauma causing exposure keratitis[16]. Studies haves reported to have managed 45% of such cases conservatively with use of eye lubricant and eye shield only while 40-45% required surgeries to manage[17.]

We recorded CP Angle Meningioma 8 (16.7%) cases with Two cases had Brainstem contusion with hemeperisis (post-traumatic). One of such case underwent per-cutaneous endoscopic gastrostomy (PEG procedure) in gastroenterology unit of the same hospital. In operating such cases careful attention is paid to preserve the arachnoid plane at tumor brainstem interface which helps complete resection of meningioma and minimal brainstem and vessel injuries[18.]

He X[6] reported 83% of their patients with total resection One death occurred due to pulmonary inflammation. Out of all CP angle tumors Meningioma are the second most common tumors, which are bening in nature and usually remain asymptomatic for longer time until develop compression of the nerves or vital organs[19].

Six (12.5%) acses with Vestibular Schwannoma with Hydrocephalus were managed with Ventriculo-Peritoneal Shunt. Obstructive hydrocephalus with acoustic neuroma occur when there is compression of 4th ventricle by the tumor. This hydrocephalus usually subsides in majority of the cases with removal of the tumor and decompression but some cases require permanent cerebrospinal fluid diversion with VP shunting due to persistent raised pressure[20]. However in majority of the cases the tumor resection only solved the issue without insertion of the VP shunt. Some of the author suggest to monitor the ventrical size post-operatively to avoid permanent shunt insersion[21,22.] Three(6.3%) of the cases were managed conservatively, one case was at 69 year of age and was not willing for surgery and in 2(4%) cases the tumor size was less than 2cm with no neurological deficit and were advised gamma knife surgery.

There were some limitations of the study. Smaller sample size restricts us to predict the application of this study on larger population. Studies executed with larger sample size can estimate the true population impact. Therefore it is suggested that future studies should cover large population

CONCLUSION:

We conclude thatVestibular Schwannoma (Acoustic Neuroma), CP Angle Meningioma, and Vestibular Schwannoma with Hydrocephalus are most common CP Angle pathologies. There is no significant association of mortality with CP angle tumors in age and gender groups. Facial nerve palsy is the major post operative complication of CP angle exploration followed by karatitis. The complication were sucessfully managed with facial hypoglossal anastomosis and torsorraphy.

Authors Contribution:
Mumtaz Ali: Conception, design, analysis and interpretation of data writing the manuscript and review
Akram Ullah: Conception, design, analysis
Ramzan Hussain: Writing the manuscript and review
Hamzullah Khan: Conception, design analysis and interpretation of data, writing the manuscript and review
Sajid Khan: Writing the manuscript and critical review

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