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Surgical Outcome of Cerebellopontine Angle Tumors: A Study of 24 Cases at the Department of Neurosurgery, Bangabandhu Sheikh Mujib Medical University, Dhaka

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Abstract

Background: *The cerebellopontine angle is a space defined by the pyramid anterolaterally, the tentorium superiorly, the pons medially and cerebellum dorsomedially. It is difficult to approach for its complication and vital structures.* ***Objective:*** *To see the outcome of surgery of cerebellopontine angle tumors at the Bangabandhu Sheikh Mujib Medical University.* ***Results:*** *Among the 24 patients 16(66.66%) were males. It was evident that 14(58.33%) belonged to the age group 41-60 years. It was documented that the majority 19(79.16%) of patients had vestibular schwannoma. Among the clinical signs and symptoms the highest group had hearing loss 20(80%). Among 24 patients the tumor was removed completely in 15(62.50%). Among the post operative complications 4(16.66%) developed facial palsy. 2(8.33%) of patients had lower cranial nerve palsy. After operation 1(4.16%) patient died due to aspiration pneumonia.* ***Conclusion:*** *Cerebellopontine angle tumor surgery is a very difficulty operation. But at a tertiary hospital, with help of microscope, we can remove the tumor completely.*

Key words: *Posterior fossa, retrosigmoid retromastoid approach, vestibular schwannoma, craniectomy, park bench position.*

Introduction:

The first description of a vestibular schwannoma (VS) was given by Eduard Sandifort in 1777, while the first successful surgical removal of VS was reported in 1894 by Sir Charles Ballance. Major advancements were made later on by F. Krause, who introduced the retrosigmoid approach to the cerebellopon-tine angle (CPA), by V. Horsley, H. Cushing, W. Dandy, and H. Olivecrona. Dandy was the first to demonstrate that the complete removal of VS should be the goal of surgery in order to prevent recurrences and that- if the capsule was dissected meticulously- the mortality and morbidity could be reduced[1,2,3].

The translabyrinthine approach was developed by Panse in 1904 but was disfavored in the following 60 years. W. House introduced the microscope and microsurgical techniques and repopularized this approach as a method not only of achieving tumor removal but also of preserving the facial nerve. He developed also the middle fossa approach to the CPA[1,2,3].

The further elaboration of the retrosigmoid approach and the introduc-tion of the microsurgical principles in the VS surgery over the last 4 decades, transformed the surgery of VS. Nowadays it is a safe procedure; complete tumor removal has become the rule and functional preservation of all cranial nerves is achieved in exceeding numbers.

Vestibular schwannoma(VS) are histopathologically benign, typically slow-growing neoplasm's and comprise 75—86% of CPA (cerebellopontine angle) tumors. VS originate most frequently from the intracanalicular part of the vestibular nerve in the

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region of the transition zone between central and peripheral myelin, generally in the medial part of the internal acoustic canal (IAC). Their natural evolution is unpredictable, with an annual growth rate between 0.2 mm and 2 mm.

The CPA is a triangular space defined by the pyramid anterolaterally, the tentorium superiorly, the pons medially, and the cerebellum dorsomedially[4]. It is located between the superior and inferior limbs of the cerebellopontine fissure. The CPA cistern contains the trigeminal, abducent, facial, and vestibule-cochlear nerves, the superior cerebellar and anterior inferior cerebellar arteries, the flocculus of the cerebellum, and the choroid plexus that protrudes through the foramen of Luschka. VS are heterogeneous tumors with varying extension pattern and unpredictable displacement of the cranial nerves in the CPA. A detailed knowledge of the complex relationship of the tumor to cra-nial nerves, cerebellar arteries, and brain structures to the VS is a prerequisite for optimizing the outcome of surgery. At the brain stem and in the internal auditory canal (IAC) the course of the nerves is relatively constant. The facial nerve exits the brain stem in the lateral part of the pontomedullary sulcus, 1-2 mm anterior to the entry zone of the vestibulocochlear nerve. The posi-tion of the nerves in the lateral portion of the IAC is also constant: the facial lies in the superior-anterior quadrant, the cochlear nerve in the inferior-anterior quadrant, the superior vestibular nerve- in the superior-posterior quadrant, and the inferior vestibular nerve- in the posterior-inferior quad-rant. In the CPA the facial nerve is found most frequently anterior to the tu-mor in the middle or upper third of the capsule. The cochlear nerve has less anatomical variation and is usually found in the anterior-inferior portion of the tumor capsule. The ninth, tenth, and eleventh cranial nerves are located in the lower part of the cerebellopontine angle[5].

Tumors of the CPA account for 5 to 10% of all intracranial neoplasms. The most frequent are VS, followed by meningiomas and epidermoid tumors[5].[5]

Materials and methods:

This was a cross sectional study which was carried out at the Department of Neurosurgery in Bangabandhu Sheikh Mujib Medical University (BSMMU) during the period of January 2010 to December 2010 and July 2011 to June 2013. Diagnosis was made by history and clinical examination and computerized tomography scan (CT scan) and magnetic resonance imaging (MRI) findings. After operation diagnosis was confirmed by histopathological examination.

Results:

Table-I

Distribution of the patients by sex (n=24)

Sex	Number	Percentage
Male	16	66.66
Female	08	33.33
Total	24	100

It was evident that the majority of patients 16(66.66%) were males.

Table-II

Distribution of the patients by age (n=24)

Age	Number	Percentage
1-20 years	1	4.66
21-40	8	33.33
41-60	14	58.33
>60	03	12.50
Total	24	100

It was documented that the highest age group was between 41-60 years 14(58.33%).

Table-III

Distribution by types of histopathology

Type of tumor	Number	Percentage
Vestibular schwannoma	19	79.66
CP angle meningioma	2	8.33
Epidermoid	1	4.16
Tuberculoma	1	4.16
Arachnoid cyst	1	4.16

The majority of patients had 19(79.66%) vestibular schwannoma.

Table-IV

Distribution by patients clinical signs and symptoms (n=24)

Signs and symptoms	Number	Percentage
Hearing deficit	20	83.32
Tinnitus	8	33.33
Vertigo	8	33.33
Facial nerve weakness	8	33.33
5^{th} nerve dysfunction	2	8.16
Lower cranial nerve palsy	2	8.16
Cerebellar dysfunction	3	12.48

It was evident that the majority of the patients 20(80%) had hearing deficit.

Table-V

Distribution of patients by postoperative complications (n=24)

	Number	Percentage
Facial nerve weakness	04	16.66
CSF leakage	02	8.33
Lower cranial nerve palsy	02	8.33
Aspiration pneumonia	01	4.16
Cerebeller dysfunction	04	16.66
Died	01	4.16

It was evident that before surgery 8(33.33%) of patients had facial nerve palsy. Postoperatively 4(16.66%) of patients developed facial palsy. Before operation 02(8.33%) of patients had lower cranial nerve palsy and after operation 02(8.33%) of patients had developed lower cranial nerve palsy.

Table-VI

Distribution of patient by extent of removal of tumor (n=24)

Extent of removal	Number	Percentage
Total removal	15	62.50
Subtotal removal	08	33.33
Biopsy	01	4.66

It was documented that the majority of tumor removed completely 15(62.50%). This was substantiated by postoperative CT scan.

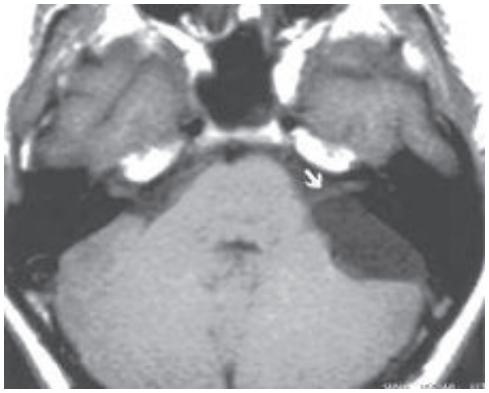

Fig.-1: *MRI of brain with contrast showed left CP angle arachnoid cyst*

Fig.-2: *MRI of brain with contrast showed bilateral vestibular schwannoma*

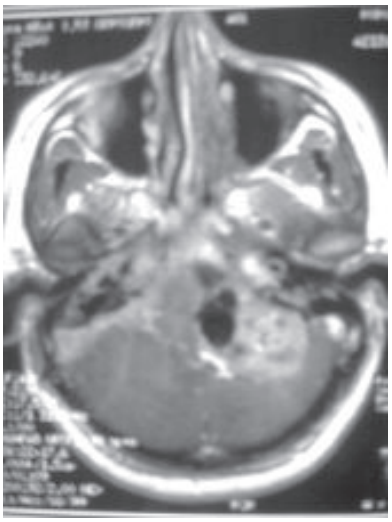

Fig.-3: *MRI of brain with contrast showed left CP angle schwannoma*

Fig.-4: *Postoperative CT scan of brain with left vestibular schwannoma with total removal of tumor*

Discussion:

In patients with CP angle tumor with hydrocephalous, we did ventriculo-peritonial shunt and did the tumor operation after shunt surgery.

VS are commonly classified according to their size or extension. However, the extension of the tumor in the CPA is more important than its diameter.

The diagnosis of VS relies on history, physical examination, and audiom-etry and is solidified by neuroradiologic examination. Audiograms generally reveal high frequency sensorineural hearing loss and speech discrimination is severely affected. Magnetic resonance imaging (MRI) is the diagnostic tool of choice for all CPA tumors. On T1-weighted MRI images VS are isointense or slightly hypointense to the normal brain and on T2-weighted images they are hyperintense. They show an intense and homogeneous contrast enhancement with the exception of cystic tumor parts.

All patient admitted with CP angle tumour undergoing surgery at the during the study period were included in this study.

The number of incidentally discovered small VS was increas-ing due to the wide spread of MRI facilities. Some of them might not show further growth or might even undergo spontaneous regression. Based on this, the conservative approach was recommended. As the natural evolution of VS still unpredictable, this strategy should be applied only in very carefully selected cases, with regular MRI follow-up at 6 to 12-month intervals. It was indicated for old and/or somatically unstable patients with small asymptomatic tumors or tumors causing mild stable symptoms. How-ever, long-term follow-up results indicate that majority of the tumors exhibit further growth and in case of larger tumors the chance of hearing preserva-tion might be much lower[7].

An alternative to microsurgical tumor removal is radiosurgery[7]. Its goal is to achieve tumor control and success rates of 93%—98% had been re-ported. Further tumor growth, however, was observed in 2% to 7% of the cases. The risk of late facial neuropathy varies from 1% to 24%, the rate of trigeminal dysfunction was 2%—27%, and hearing preservation was achieved in 40—74%. The optimal treatment of VS was complete tumor removal with preservation of all neurological functions. This goal was achieved in ever increasing numbers in different highly specialized centers. The three most commonly used opera-tive approaches are the translabyrinthine, the middle fossa and the retrosig-moid. The selection of the approach is related to factors such as tumor size, extension in the IAC, preoperative hearing level, and mostly — surgeon's ex-perience, preferences, and institutional tradition[1,2,3,8].

In our institution we had operated all the cases through suboccipital retromastoid and retrosigmoid approach. We feel comfort with this approach and excellent results have been achieved with each of these techniques and complete tumor removal was achieved in 80%—99%[1,2,3,8]. In our study we removed 15(62.50%) tumors completely.

The retrosigmoid suboccipital approach is the most popular among neu-rosurgeons[1,2,9]. It offers: an excellent panoramic visualization of the whole CPA; increased safety during dissection from the brain stem and lower cranial nerves; possibility to preserve hearing even in large VS; identification of the facial and cochlear 'cranial nerves both in their proximal (close to the brain stem) and lateral part (in the

IAC) thus increasing the chances for their preservation; and possibility to reconstruct the facial nerve in the CPA at the same surgery, if needed. Some drawbacks, traditionally ascribed to the ap-proach- need of cerebellar retraction, difficult visualization of the most lateral part of the IAC without endangering the integrity of the inner ear; higher rate of postoperative headache- have been largely overcome with some modification of the original technique described below.

In our study we had removed all tumors 24(100%) through the retrosigmoid, retromastoid and suboccipital approach.

The dissection of the capsule should begin only after adequate internal decompression is achieved. It is performed by strictly gripping the tumor capsule and dissecting in the level of the arachnoid plane under continuous saline irrigation. As most of the microvascular blood supply to the nerves is in the subarachnoid space, it is important that dissection of the nerves from the capsule should proceed in the correct plane[9,10]. The tumor was dis-sected medially along the brain stem for identification of the medial part of the facial nerve. Then, the nerve was dissected from the upper tumor por-tion. Pulling of the rest of the capsule medially and upward, allowed visualization of the lowest and most lateral aspects of the facial nerve. The dissection was alternated from different directions. In order to avoid thermal injury to the vulnerable cranial nerves, bipolar coagulation was reduced to a minimum and left up to the end of surgery for final hemostasis. In the area just medial to and inside the porus the facial and .cochlear nerves were generally extremely adher-ent to the tumor. This tumor part was dissected at the end[10,11].

We did all case in park bench position, as we had no CUSA (Cavintron Ultrasonic Aspirator) or any nerve evoke potential monitor. We had no facial nerve monitor, or lower cranial nerve monitor or pneumatic drill. It is very challenging for us to do the surgery of CP angle tumor with this limitations. We did all the operation with the help of microscope.

Before operation 8(33.33%) of patients had developed cerebellar dysfunction and after operation 4(16.66%) more patients had cerebellar dysfunction.

In our study we could preserve facial nerve function in 12 patients. In previous study at last follow-up examination 81% of the patients had excel-lent or good facial nerve function and there were no patients with total facial palsy. Hearing preservation is strongly dependent on the level of preoperative hearing and the auditory brain stem response, and to a lesser extent on tumor size. If functional hearing was available preoperatively, the anatomical integ-rity of the cochlear nerve was preserved in 84% and the overall rate of hearing preservation after surgery was 51%[12].

Before operation 2(8.33%) patients had lower cranial nerve palsy and after surgery 2(8.33%) patients had lower cranial nerve palsy. With our minimum facilities at operation theater, postoperative outcome was not satisfactory with compared to the better equipped centers .In vestibular schwannoma though it is difficult to approach early surgery with proper equipment and proper postoperative care can save many lives and prevent morbidity.

Conclusion:

Among the different approaches suboccipital retrosigmoid, retromastoid approach is the gold standard for CP angle surgery. Postoperative outcome is satisfactory with reducing morbidity and mortality with proper equipment and postoperative care.

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