Cerebellopontine Angle Tumors; Tumor Size – Outcome Relationship

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ABSTRACT:

BACKGROUND:

Cerebellopontine angle is an area with extremely critical structures, therefore understanding its tumors behavior with the implications on the surgical outcome will help in reduction of the possible surgical complications, eventually improves the patients quality of life.

OBJECTIVE:

Our object is to illustrate the various aspects of clinical presentation and surgical complications with linkage to the tumor size regarding cerebellopontine angle (CPA) tumors in Iraq.

PATIENTS AND METHOD:

A prospective cohort study for thirty patients at the Surgical Specialty Hospital (Al Shaheed Ghazi Al Hariri Hospital) have been studied over a 1-year period (2014 / 2015), and followed up postoperatively for 6 months. Their mean age of was 36 years. The suboccipital retrosigmoid approach has been utilized for CPA tumors removal.

RESULTS:

The most common presentation was vertigo followed by tinnitus. There were two cases (6%) of cerebrospinal fluid leak. Facial nerve function was measured by the House Brackmann (HB) system and function further classified into three categories: excellent (HB I-II), intermediate (HB III-IV), and poor (HB V-VI) outcome following surgery, showing that all cases below 20 mm tumor size have an excellent outcome and (67%) of cases with > 20 mm tumor size shows poor outcome. One death in this study (mortality rate, 3%) was due to respiratory cessation.

CONCLUSION:

A female preponderance noticed. Significant relationship between tumor size and facial nerve postsurgical functional outcome, with the larger C.P.A. tumors yield worse outcomes. Tumor size also influences the development of CSF leak and operative morbidity and mortality.

KEY WORDS: Cerebellopontine angle tumors, facial nerve, CSF leak.

INTRODUCTION:

The Acoustic schwannoma is the most well-known tumors of the cerebellopontine angle (CPA) (80–90%) trailed by Meningioma (5– 10%), Ectodermal inclusion tumors, Epidermoid and Dermoid (5–7%). These tumors might be asymptomatic or may give rise to symptoms which could be attributed to tumor mass and association of the nearby cranial nerves, cerebellum, and brainstem. Moreover, there could be related signs and symptoms because of raised intracranial pressure (ICP) because of brainstem compression and hydrocephalus. The most well-known presentations of CPA tumors are a one-sided sensorineural hearing loss (96%), unsteadiness (77%), tinnitus (71%), headache (29%), mastoid pain or otalgia (28%), facial numbness (7%) and diplopia (7%). [1]

Choices for CPA tumors management incorporates observation, surgery, stereotactic radiosurgery, fractionated radiotherapy. A few patients may likewise be subjected to one or more of these treatments. [2] The ideal treatment focus on total removal of the tumor. Surgery is indicated for small, medium and large size tumors. [3] Several approaches have been advocated and various techniques are available for the resection of CPA tumors, including translabyrinthine, retrosigmoid, suboccipital, retrolabyrinthine, transcochlear, transotic and middle fossa approaches. [4] Surgery enhances personal satisfaction in patients however each approach has postoperative complications like the hematoma, pneumocephalus, cranial neuropathies, cerebellar dysfunction, brainstem

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complications, infections CSF leak and mortality. [4]

The Suboccipital retrosigmoid approach has gained popularity as a method of excising CPA tumors. Advantages of this approach include a low complication rate, particularly with regard to facial nerve function, and the completeness of tumor removal in most of the cases. Additionally, the technique is safe and effective, even with large tumors. [5]

The outcome and prognosis for cure from surgical resection depends on the histology, size, and location of the tumor and the approach chosen. Cessation of tumor growth from primary radiation also depends on the specific factors listed above. Expected facial palsy rates are high for primary facial schwannomas. The effect on quality of life from facial nerve palsy is quite significant. Results also depend on the experience and skills of the surgeon. [5]

MATERIAL AND METHODS:

This is a prospective study of 30 patients at the Surgical Specialty Hospital between Sept. 2014 and Sept. 2015. The suboccipital retrosigmoid approach was the surgical procedure utilized for tumor removal. MRI performed to all patients for the radiological diagnosis. The data collected includes the patient's gender, size of the tumor and postoperative complications. Tumors sizes divided into 3 categories (1-10 mm, 11-20 mm, >20 mm) and preoperative symptoms were categorized in relation to the tumor size. Facial nerve function was graded according to the House Brackmann scale (HBS) after surgery and allocated into three categories: excellent (HBS I-II) and poor (HBS V-VI) outcomes. Patients were followed up postoperatively over 6 months.

The inclusion criteria were as follows 1) MRI of the head done preoperatively for all patients; 2) Thin slices 3 teslas MRI used for diagnosis; 3) patients operated by the suboccipital retrosigmoid approach.

The exclusion criteria include 1) patients with previous brain irradiation; 2) associated hydrocephalus; 3) internal auditory canal involvement by tumor; and 4) patients referred by other than a neurosurgeon.

RESULTS:

30 patients with a mean age of 36 years (range, 20–65 years) were included in this study. The histopathological diagnosis of CPA tumors in which acoustic neuroma represents 70% of all cases followed by meningioma 20% while epidermoid cyst, astrocytoma and lipoma represented in 10% of cases.

There is female predominance (60%) in relationship with mean tumor size of 18 mm. This relation is significant at $p < 0.05$ with χ 2 (15.5737) and *p*-value (0.000415) as shown in figure 1.

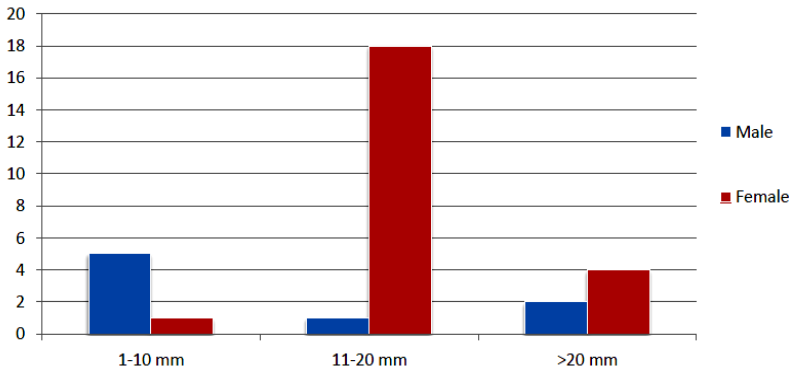

Figure 1: Shows distribution of tumors by size with respect to gender.

Regarding the presenting symptoms related to tumor size, twenty- three patients (76.6%) presented with vertigo while tinnitus presented in 14 patients (46.6%). In both previous groups, the tumor sizes fall in the 11-20 mm in maximum diameter. Five patients had facial palsy preoperatively with mean tumor size of 20 mm. Those results are statically significant with χ 2 (13.9751) and *P-value* (0.007375) at $p < 0.05$ as shown in Table 1.

Table 1: Shows patients preoperative symptoms in relation to tumor size.

Tumor size	Vertigo	Tinnitus	Facial palsy
1-10 mm (4)	3	1	0
11-20 mm (20)	15	10	1
> 20 mm (6)	5	3	4
Total (30)	23(76.6%)	14(46.6%)	5(16.6%)

The results regarding postoperative outcome in patients that showed on table 2 was as follows:
Surgery showed overall improvement regarding both vertigo and tinnitus, as there is total improvement in the (1-10 mm) group while as the tumor size increases, especially for the (>20 mm) group, there is still residual symptoms of vertigo and tinnitus and this is significant with χ 2 (16.9451) and *P-value* (0.006105) at $p < 0.05$.
Regarding facial nerve functional outcome in relation to tumor size, Twenty-five patients had an excellent functional outcome. All cases below 20 mm tumor size have an excellent outcome and (67%) of cases with > 20 mm tumor size shows poor outcome this is of great significance with χ 2 is 22.272, the *p*-value is 0.000015 at $p < 0.05$.
CSF leakage occurred in two patients (6%).These cases were handled conservatively with application of wound dressing and bed rest the mean tumor size in patients with CSF leaks was 25 mm, compared with 15 mm in patients without CSF leaks, χ 2 is 8.5714, the *p*-value is 0.003415 at $p < 0.05$ this give a strong evidence of correlation between tumor size and CSF leak.
Bacterial meningitis was indicated by the presence of the classic symptoms and was confirmed by CSF analysis. Of the 2 patients diagnosed with CSF leakage in this series, one had concomitant bacterial meningitis resolved with intravenous antibiotic therapy, χ 2 is 4.1379 and *p*-value is 0.041932 at $p < 0.05$ which is significant.
There was one death in this series (mortality rate, 3%), χ 2 is 14.4828 and *p*-value is 0.000141 at $p < 0.05$, which was due to respiratory failure.

Table 2: Shows post operative outcome in patients.

Tumor size	Vertigo	Tinnitus	Facial nerve function (HB)		CSF leakage	Meningitis	Mortality
			excellent	poor			
1-10 mm	0	0	4	0	0	0	0
11-20 mm	2	1	20	0	0	0	0
> 20 mm	3	3	1	4	2	1	1

DISCUSSION:

In our study, acoustic neuroma constituent of about (70%), and meningioma (20%) and those readings are close to the study made by Thaba BK et al. BSMMU, Dhaka where acoustic neuroma represents 77% and Meningioma 15 %. [6]
Female predominance noticed 76.6%, this is in part related to hormonal, genetic factors. In addition, the average tumor size in which majority of female patients was 18 mm. In series of Memari F et al, there was male predominance. [1]
Mainly vertigo and tinnitus are the main presentations in the study, 76.6%, and 46.6% respectively. In the literature, reports of balance disorder in vestibular schwannoma vary widely. Some authors investigate that it may be the presenting symptom in 15% of cases. Continuous

or intermittent tinnitus with concomitant hearing loss is present in approximately 90% of cases and is nearly always unilateral. [7]
Tinnitus which has generally been found in association with hearing loss in other series like the one of Moffat et al., and Thomas NW, although others have also pointed out that it is also an infrequent complaint in non-acoustic cerebellopontine angle lesions. [8] We have found 46.6% of cases of vertigo such as have been reported by Lalwani AK et.al. [6,9]

Both vertigo and tinnitus improved dramatically postoperatively, with best results encountered in 1-10 mm and as tumor size increase, especially for tumors above 2 cm, the above symptoms persist more and this in part related to the duration of symptoms and the pressure of neural tissues by the tumor mass. Jain V k et al [9] had the incidence of cranial nerve paresis has been 6.8% in their study.

The suboccipital retrosigmoid approach was the standard procedure in all cases described in our study. Similarly, Glasscock *et al.*, reported on the retro mastoid and middle fossa approaches in 161 selected patients. They found a lower incidence of temporary facial nerve paresis using the retrosigmoid approach. [10]Mazzoni et al. reported on a selected series of 90 of 300 patients operated on using the retro mastoid approach for a trial of preservation of hearing. The facial nerve was preserved in 99%, with completely normal function in 78%. The cochlear nerve was anatomically preserved in 96% and functionally in 44 %. [11]

Rates of CSF leakage have fallen dramatically according to the refinement of surgical techniques. Previously reported rates of 20% have declined with the use of fat packing into the mastoid region and obliteration of the Eustachian tube and middle ear space. [12] In our series, CSF leaks developed in 6% of patients. This rate is comparable with other recent series that have placed rates at 6–16%. [12] We found that tumor size can influence the development of CSF leaks. Both Slattery et al.[13] and Brennan et al. [14]found a significant relationship between tumor size and the prevalence of CSF leakage; according to Brennan et al., larger tumors appeared to lead to a greater risk of CSF leak; however, Slattery et al. showed a correlation between surgical approach and CSF leakage rate, with a retrosigmoid approach having the highest frequency (15%) and middle fossa approach the lowest (5.7%).[13] Based on these findings, it can be concluded that tumor size and type of surgical approach are the main factors affecting postoperative CSF leakage.

Our study shows a clear relationship between increasing tumor size and worsening facial nerve outcome. This is not surprising, as larger tumors tend to become more intimately involved with the facial nerve or significantly alter its course. Studies show that both the type of surgical approach and tumor size are the main factors significantly affecting postoperative facial nerve function. [15]

The anatomical facial nerve preservation rate has been reported to be 80–90%.[15] The preservation of facial nerve function has been reported to be 70–80% for tumors greater than 3 cm in diameter, removed either by the retrosigmoid. [15] The reported preservation rate of "excellent" function after the removal of large tumors is 42–52.6% [15] which is comparable to our study 50% for tumors > 20 mm.

Bacterial meningitis encountered in one patient in our study who had concomitantly a CSF leak which gives attention to the aggressive measures to prevent and to treat the CSF leak both intra and postoperatively. Though the 3% meningitis (one patient) if compared to other studies [16] it's so promising and with high positive predictive value.

The mortality in our study (one patient) was due to respiratory failure manifested as a failure of successful extubation postoperatively and loss of protective reflexes this attributed to the tumor mass compressing the brainstem and its related ischemia. If compared to figures reported in the literature, it can be justified taking into consideration, the high percentage of late presentation, the availability of the diagnostic aids the lack of intra-operative monitoring shows that the mortality dropped from 85% in Henschs cases reported in 1910 to 4% by Cushing 22 years later.[11][17]

CONCLUSION:

1) Cerebellopontine angle tumors size influences the development of both intra and postoperative complications with operative morbidity and mortality.

2) There is an obvious and significant relation between tumor size and preoperative symptoms, postoperative facial nerve outcome and CSF leak with larger C.P.A. tumors yield worse outcomes.

3) Overall female predominance has been noticed among patients.

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