ORIGINAL ARTICLE

# Surgical Outcome of Cerebellopontine Angle Tumours by Retrosigmoid Approach

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## *ABSTRACT*

***Objective:*** *To determine the microsurgical outcome of cerebellopontine angle tumours by the retrosigmoid approach.*

***Study Design:*** *Quasi experimental study.*

***Place and Duration of Study:*** *Departments of Neurosurgery Lahore General Hospital and mayo hospital, Lahore from January 1998 to June 2015.*

***Materials and Methods:*** *Four hundred and fifty six patients of cerebellopontine angle tumours of various histologies were operated at the Departments of Neurosurgery, Lahore General Hospital and mayo hospital, Lahore, from Jan 1998 to June 2015. All patients with unilateral or bilateral lesions from 15 to 65 yrs of age and with all different pathologies in cerebellopontine angle were included in the study. Complete blood count, X-Ray Chest and MRI Brain plain and with I.V contrast were done. Patients with pre-operative radiosurgery, multiple surgeries and those unfit for surgery were excluded from the study. All patients were operated under general anaesthesia by retrosigmoid approach in park bench position. Preservation of the facial nerve was attempted in all cases. Post op facial nerve status was compared with pre-op grade by House – Brackman grading. Post op development of hydrocephalus and other cranial nerve complications were also noted and overall morbidity and mortality was studied.*

***Results:*** *Four hundred and fifty six patients, 274 men (60.1%) and 182 women (39.9%), underwent micro-surgical excision of cerebellopontine angle tumours. 410 (89.9%) patients were vestibular schwannomas,22 (4.8%) were meningioma, 9 (1.9%) were epidermoid and 13 (2.8%) were all other pathologies in cerebello-pontine angle tumours. Patient ages ranged from 15 to 65 years (mean 44.11±8.41 years). All patients were operated by the Retrosigmoid approach. Complete resection was achieved in 237 patients (51.9%), subtotal resection (STR) in 209 patients (45.8%), and near-total resection (NTR) in 10 patients (2.1%). Good facial nerve outcomes (House-Brackmann [HB] Grades I-III) were achieved in 82% of the patients who had undergone either NTR or STR, as compared with 73% of patients who had undergone gross-total resection (GTR). Complications included wound infection (2 patients), delayed CSF leakage 10 (2.1% of patients), hydrocephalus requiring VP shunt in 15 (3.2%), basal cranial nerve palsy in 45 patients (9.8%) and mortality in 10 (2.1%).*

***Conclusion:*** *Retrosigmoid approach is relatively easy and safe approach for cerebellopontine angle tumour. Tumours of all sizes can be operated completely and facial nerve can be identified and saved with this approach with less operative time and less chances of CSF leak.*

***Key words:*** *Retrosigmoid approach, cerebellopontine angle, House – Brackmann grading.*

## INTRODUCTION

Vestibular Schwannomas (VS), also known as, Acoustic Schwannomas, are relatively common tumours that arise from the vestibulocochlear nerve (CN VIII).

About 6 to 10% of all intracranial tumours arise in or involve the cerebellopontine angle (CPA) and the vast majority of these (~80%) are vestibular schwannomas.[1,2] Meningiomas and epidermoids account for ~10% and 6%, respectively, and the remainder consist of an extremely heterogeneous group of tumours that affect this region.[1,2] The CPA is lined by the meninges and in addition to cerebrospinal fluid contains nerves, vessels, and possibly embryologic remnants. Each of these structures can be the tissue of origin of an unusual non-vestibular schwannoma. Approximately one in five CPA tumours is not a vestibular schwannoma. Following the introduction of the operative microscope by House in the early 1960s,[10] the mortality and morbidity rates of VS surgery dramatically declined. Surgical techniques and equipments have since been progressively refined. The main goals of modern VS surgery are maximal tumour resection with complete functional preservation of all cranial nerves including the facial nerve (FN).[11,12] FN preservation is critical because postoperative FN dysfunction seriously impairs the patient's quality of life. Vestibular Schwannomas present with an insidious hearing loss that develops over a period of several years, a pattern quite different from most of the less common CPA tumours.[3] Larger CPA tumours can inflict functional deficits on any of the cranial nerves that traverse the cerebellopontine angle or neural structures that form part of its boundaries, namely, the pons and cerebellum. These tumours cause altered facial and corneal sensation, nystagmus, ataxia, and facial palsy. The sequence of these symptoms may suggest that the lesion is a non-vestibular Schwannomas.[4] MRI is the investigation of choice for cerebellopontine angle tumours.Most Vestibular Schwannomas have an intra-canalicular component, and often result in widening of the porus acousticus resulting in the trumpeted IAM sign, which is present in up to 90% of cases (Figure 1). In a minority of cases (~20%) they are purely extra-canalicular, only abutting the porus acousticus. Meningioma have wide dural base with no intracanalicular component (Figure 2) and epidermoid usually have cauliflower like appearance (Figure 3). Controversy exists regarding the optimal form of treatment for the vestibular schwannomas. Small tumours that do not pose a risk to brain function and do not produce symptoms can be followed with follow-up MRI scans to ensure "control". This is most often an attractive option in older individuals with small tumours. The patient's age < 66 years and the size of the acoustic neuroma > 2 cm was our recommendations for microsurgical treatment of acoustic schwannoma because long-term follow-up after microsurgical treatment documents a high cure rate and better quality of life. CP angle tumours can be removed by three approaches with certain advantages and disadvantages. These are retrosigmoid, translabyrinthine and the middle fossa approaches. Another

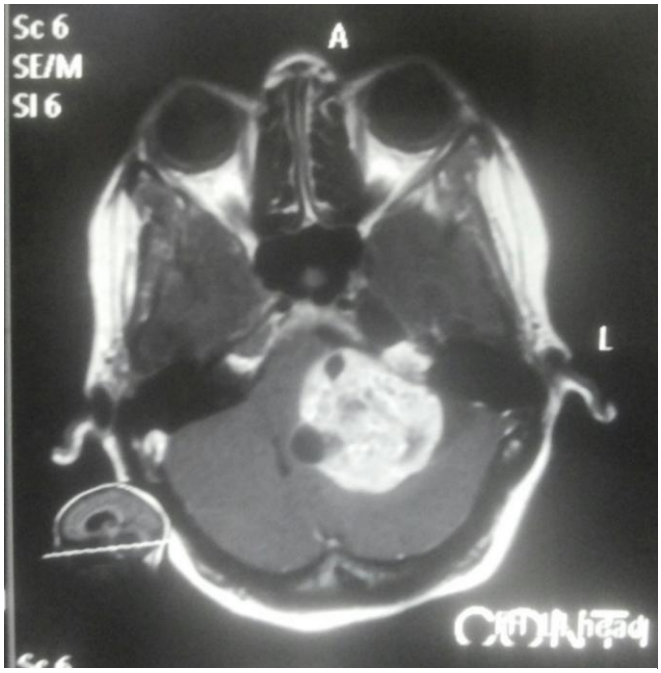



**Figure 1:**

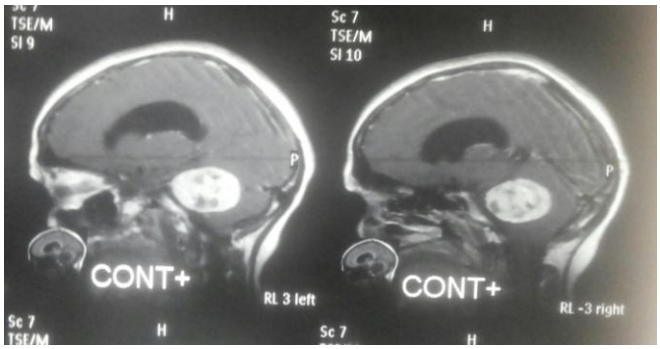



**Figure 2:**

treatment option is radiosurgery to control tumour growth. The chances of facial nerve preservation after retrosigmoid microsurgery in CP angle tumours are high. In the immediate postoperative period, 62.1% of patients displayed normal or near – normal facial nerve function (House – Brackmann Grade 1 or 2) after surgery for VS. This number rose to 85.3% of patients at 6 months after surgery.

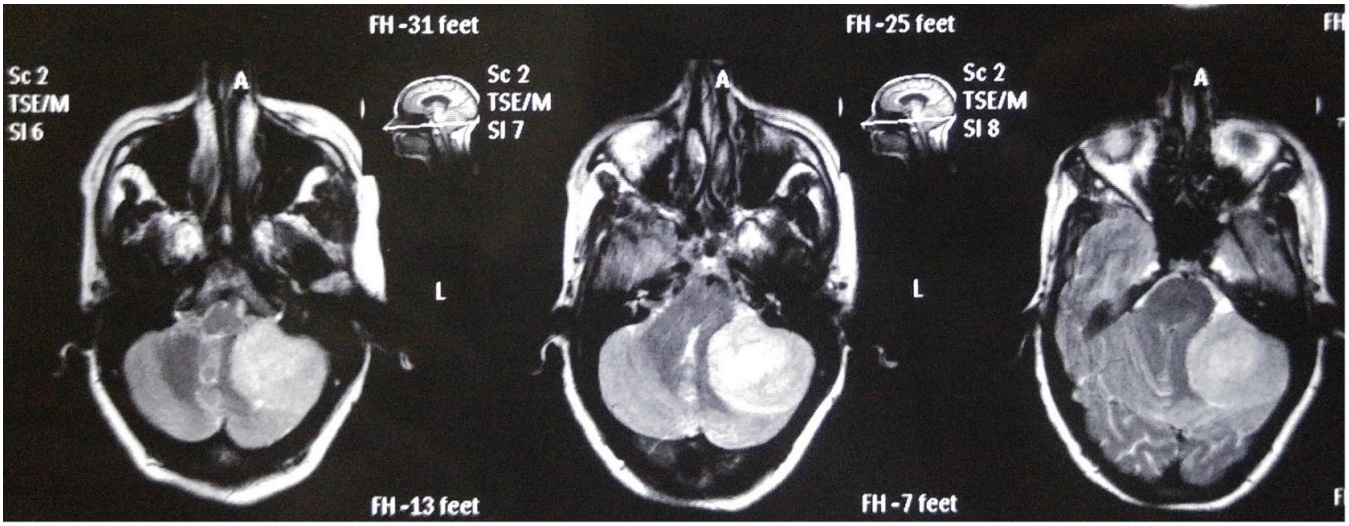



**Figure 3:**

## MATERIALS AND METHODS

This study was carried out in the Departments of Neurosurgery Unit 1, Lahore General Hospital and Mayo hospital, Lahore from January 1998 to June 2015. Patients of either sex who had any tumours in cerebellopontine angle and causing compression over cranial nerves, brainstem and cerebellum with size more than 2cm and age less than 65 years were included in the study. Patients more than 65 years of age and tumour size less than 2cm and patients not fit for anaesthesia and those patients who underwent radiosurgery or previous surgery were excluded from the study. This study was approved by the ethical committee of these hospitals and informed consent was taken from all patients. Pre-operative facial nerve status was graded according to House – Brackman grading system. Canial nerves palsy was present in all patients with large tumours especially when diagnosis was meningioma. Only five patients presented with trigeminal neuralgia. CBC, X-Ray chest and MRI brain with i.v. contrast were done in all patients.MRI was assessed for size and extent of the tumour, associated hydrocephalus and presence of other pathologies. The degree of resection was visually evaluated intraoperatively and by MRI within a few days after surgery. The extent of tumour removal was classified as gross total resection (GTR), near – total resection (NTR), subtotal resection (STR), and not resected (NR). NTR was defined as the presence of a tiny fragment or thin layer of residual tumour on the nerves or brainstem. STR was defined as a less extensive resection than NTR.

Post-operative facial nerve status was also graded and recorded. Post op development of hydrocephalus and other cranial nerve palsies and overall patient morbidity and mortality were also recorded in all patients. Retrosigmoid craniectomy followed by microsurgical removal of cerebellopontine angle tumour was done. Post operative CT scan was done after 24 hours or earlier in all patients to see the tumour bed and ventri-

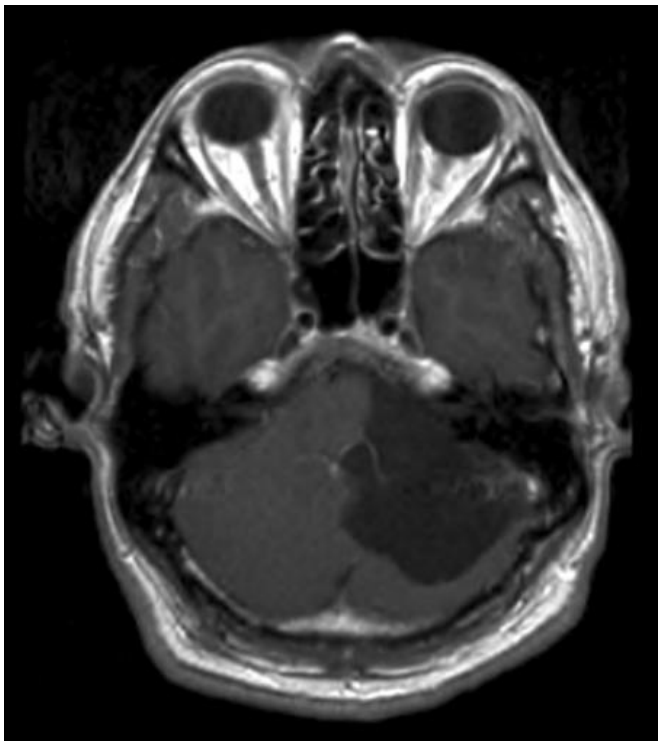


**Figure 4:**

cular system and later on if required according to clinical condition of the patients (Figure 4). Patients were discharged on tenth postoperative day and follow up was done at the end of one month, 6 month and then at the end of one year. All patients underwent scheduled physiotherapy including postural turning, bowel and bladder care, chest physiotherapy and balance therapy.

Data about the age, gender, tumour type on MRI findings, facial nerve grading, other cranial nerve palsy, post op hydrocephalus and surgical outcome were entered into a proforma for collection and analysis. Data was analysed using SPSS version 20. Mean value ± S.D was determined for quantitative data like age and frequency was determined for qualitative data like gender. Wilcoxin signed rank test was applied to compare scores before and after surgery. *P* value < 0.001 was considered as significant.

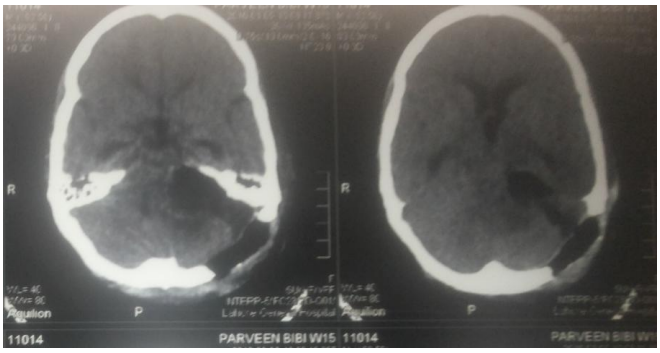



**Figure 5:**

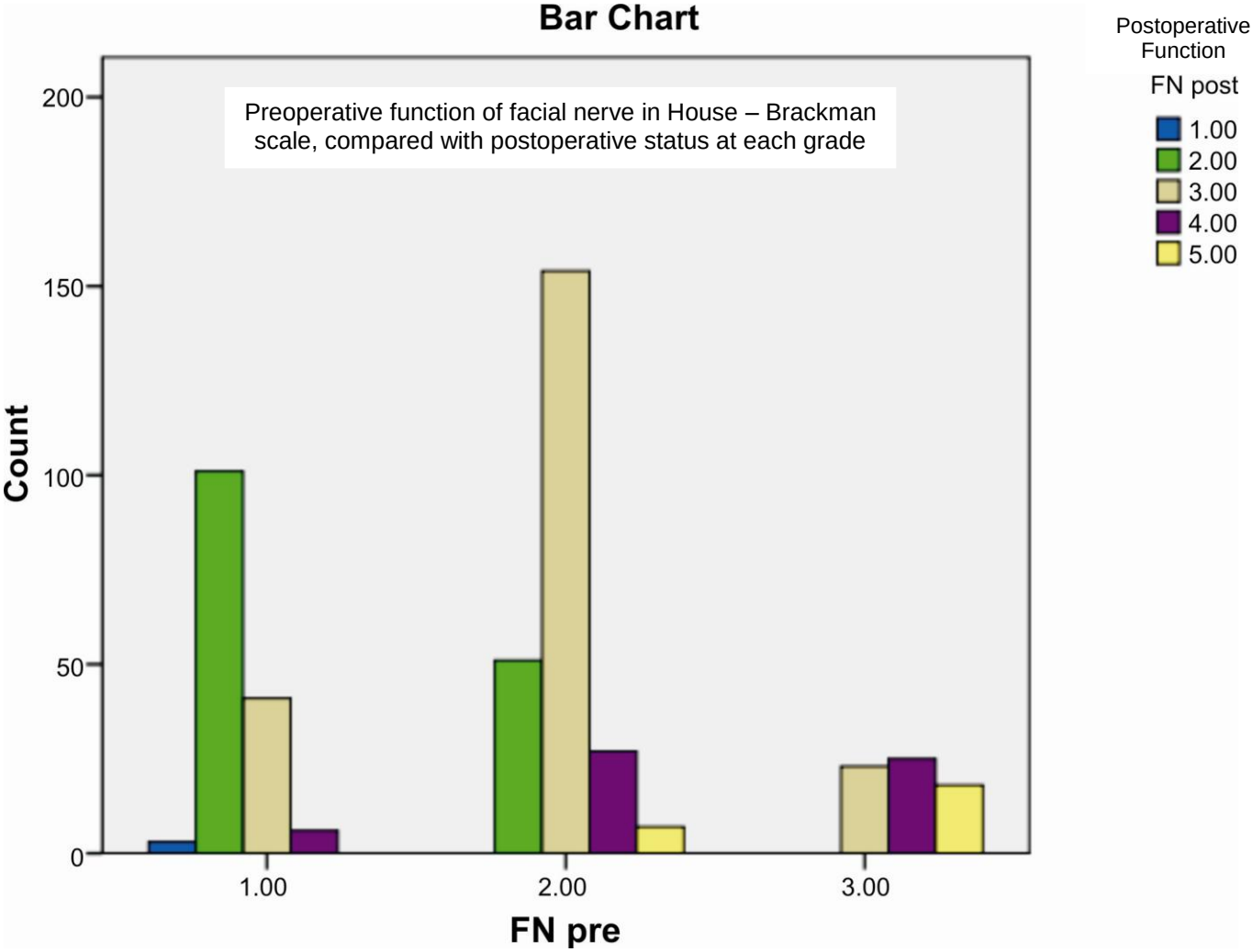
## RESULTS

Four hundred and fifty six patients, 274 men (60.1%) and 182 women (39.9%), underwent microsurgical excision of cerebellopontine angle tumours. 410 (89.9%) patients were vestibular schwannomas, 22 (4.8%) were meningiomas, 9 (1.9%) were epidermoid and 13 (2.8%) were all other pathologies in cerebellopontine angle tumours. Patient ages ranged from 15 to 65 years (mean 44 ± 8.41 years), and the mean maximal tumour diameter was 3.73 cm (range 2.0 – 5.0 cm). Patients most frequently presented with headache, hearing loss, vertigo, and dizziness. Preoperative facial numbness was reported in 44% of patients. All patients were operated by the Retrosigmoid approach. Complete resection was achieved in 237 patients (51.9%), subtotal resection (STR) in 209 patients (45.8%), and near-total resection (NTR) in 10 patients (2.1%). Good facial nerve outcomes (House – Brackmann [HB] Grades I – III) were achieved in 82% of the patients (Figure 5) who had undergone either NTR or STR, as compared with 73% of patients who had undergone gross-total resection (GTR).

**Figure 5:**

| Descriptive Statistics | | | | |
|---|---|---|---|---|
| | **Age** | **Size** | **FN pre** | **FN post** |
| Mean | 44.11 | 3.73 | 1.81 | 2.89 |
| Std. Deviation | 24.62 | .62 | .66 | .83 |
| Range | 531.00 | 3.00 | 2.00 | 4.00 |
| Minimum | 3.00 | 2.00 | 1.00 | 1.00 |
| Maximum | 534.00 | 5.00 | 3.00 | 5.00 |

Complications included wound infection (2 patients), delayed CSF leakage 10 (2.1% of patients),




**Preoperative function of facial nerve**

**Fig. 6:** *p-value < 0.0001, Significant Improvement in FN after Surgery.*

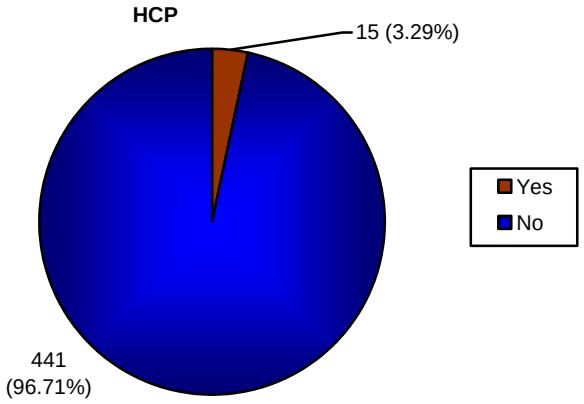



**Fig. 7:** *Postoperative Hydrocephalus.*

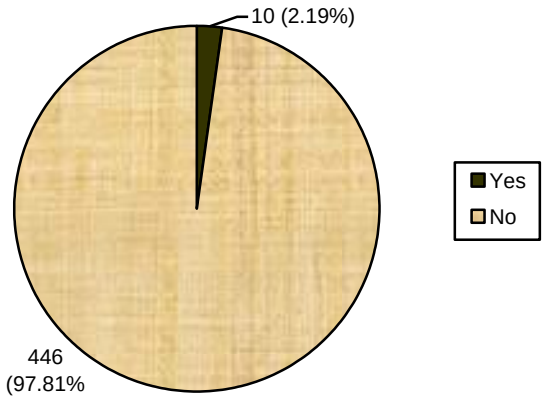



**Fig. 8:** *Mortality.*

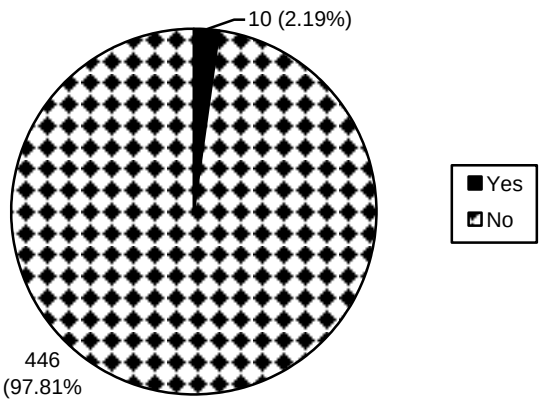



**Fig. 9:** *CSF Leak.*

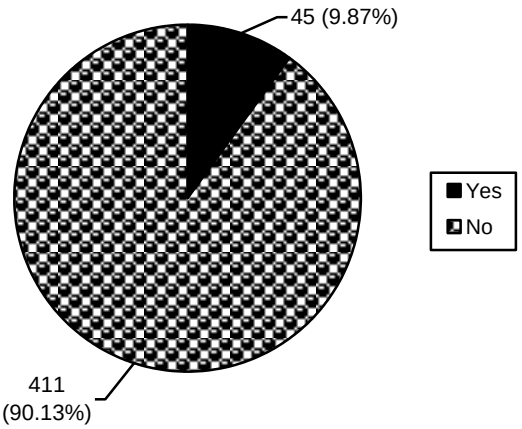



**Fig. 9:** *Other Cranial Nerve Complications.*

hydrocephalus requiring VP shunt in 15 (3.2%), basal cranial nerve palsy in 45 patients (9.8%) and mortality in 10 (2.1%).

## DISCUSSION

The first symptom evaluated in our study was gradual loss of hearing in one ear, often accompanied by ringing in the ear (tinnitus) or a feeling of fullness in the ear. Less commonly, acoustic neuromas may cause sudden hearing loss. Classic presentation of acoustic neuroma confined to the internal auditory canal, involves unilateral progressive hearing loss, vestibular dysfunction and tinnitus. The severity of tinnitus has been shown to correlate with tumour size.[14] MRI was done in all patients to study the tumour and its relation with cranial nerves and brainstem and classify tumour according to size. MRI has largely superseded CT scanning as the investigation of choice for suspected acoustic neuroma and other cerebellopontine angle tumours.[15] The growth pattern of acoustic neuromas is variable. As many as 75% of tumours have been reported to show no growth. However, there are no reliable predictors of tumour growth pattern.[16] There is ongoing discussion whether to follow the patient, go for radiosurgery or microsurgery. There are three treatment options: microsurgery (the technique of choice), stereotactic radiosurgery and observantion.[17] In the UK, most patients receiving active treatment undergo microsurgery. The surgical approach taken depends on the location of the tumour, its size and the relative importance of hearing preservation. Complete removal is possible in most cases. The risks of surgery includes[18] Mortality (about 1%), CSF leak, meningitis, cerebellar injury, stroke and facial paralysis (either partial or complete). We operated all patients by Retrosigmoid approach. Facial nerve preservation continues to be a primary concern of patients undergoing microsurgery for vestibular schwannomas. Despite the currently available international data there have been no local statistics available to compare with the international studies for preservation of facial nerve with microsurgical technique. In this study we performed a comprehensive analysis of facial nerve functional preservation in a large aggregated population of patients who underwent microsurgery for vestibular schwannomas and other cerebellopontine angle tumours. We were able to save facial nerve in 82% of patients. Gormley et al,[7] reported the preservation of postoperative facial nerve function and showed preserved function (House – Brackman grade I or II) in 96% of small tumours (less than 2 cm diameter), 74% of medium tumours (2.0 – 3.9 cm), and 38% of large tumours (4.0 cm and greater). Further, a "fair" postoperative function (Grade III or IV) was achieved in 4% of small tumours, 26% of medium tumours, and 58% of large tumours. Other studies have corroborated this inverse relationship between size of the tumour and preservation of the facial nerve function.[8] One development that has served to reduce the rate of complications with surgical removal of acoustic neuroma was electrophysiologic monitoring allowing for nerve identification, delineation of its course, and

preservation of the nerve trunk by signals disturbances in the nerve's activity before injury occurs. The continuous intraoperative monitoring of the facial nerve demonstrated that long-term rates of unsatisfactory facial nerve function were reduced from 7% to 3% with the use of intraoperative monitoring.[9] Recent studies have demonstrated that low dose radiosurgery has a favourable efficacy/ toxicity ratio as compared to higher doses and with more than 80% chances of facial nerve preservation.[10] The rates of tumour control following surgery are high and generally exceed 95%.[19] The Johns Hopkins experience indicates a 99.1% tumour control with over 8 years average follow-up.[20] In our study we have not seen any recurrence that requires re-treatment of the lesion after microsurgery.

The limitation of our study is that the follow-up duration was relatively short as patients don't keep their appointment after a year or so. Multicentre studies with long follow up are required to determine proper guideline.

## CONCLUSION

Retrosigmoid microsurgery is a relatively easy and safe procedure for all types of lesions in cerebellopontine angle with minimum chances of mortality and good chances of facial nerve preservation.

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