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ORIGINAL ARTICLE

CLINICAL PROFILE AND SURGICAL OUTCOME OF VESTIBULAR SCHWANNOMAS: AN INSTITUTIONAL EXPERIENCE

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ABSTRACT: AIMS & OBJECTIVES: Vestibular schwannomas manifest with very serious deficits of hearing, facial expression, lower cranial nerve, cerebellar and brain stem functions either preoperatively or as a consequence of surgical intervention. Our objective was to analyse the symptomatology and clinical signs and try to correlate with postoperative outcome and complications in the setting of limited infrastructure, therapeutic and monitoring aids and multi-surgeon involvement with varied spectrum of surgical expertise in a single large tertiary teaching institute. **METHODS:** We retrieved 110 patients with Vestibular schwannomas from the Discharge Summary records of the Department Of Neurosurgery, Nizam's Institute Of Medical Sciences, and Hyderabad from January 2004 to April 2010. The mean age/sex distribution, clinical symptomatology, presenting signs were documented. The operative and clinical findings were evaluated. Data were obtained regarding presenting clinical features, histopathological data after surgical resection, surgical morbidity, mortality and clinical outcome (follow up of 6-12 months). Clinical features and surgical outcome were analysed. **RESULTS:** The mean tumor size was 4.4 cm. Giant tumours [>4 cm] constituted 74 % of patients. All patients had significant hearing loss which was the most common initial symptom. In 80 % of cases, gross total tumor resection was achieved. In 20 % of cases, deliberate subtotal resections were performed. These were due to adhesions to brain stem in 4 % cases and for facial nerve preservation in 5% cases. Anatomic facial nerve preservation was achieved in 84 % in tumours < 3 cm size. The overall anatomic facial nerve preservation rate was 33.6 %. The rate of functional facial nerve preservation [H-B Grade 1-2] was 67.2 % in cases of small tumors (< 30 mm). The overall functional facial nerve preservation [H-B Grade 1-2] was 28.2 %. Overall mortality was 5.4 % [6 cases] out of which 4.5 % [5 cases] were due to operative site haematoma. **CONCLUSION:** Hearing loss is the main symptom of vestibular schwannoma. The indication and the timing of tumor resection is dependent on the tumor extension and related necessity of brain stem decompression and on the auditory function. In summary, the chances of good outcomes [Facial nerve preservation and post op morbidity] are best when surgery is performed early [smaller size tumours] and when there is good preoperative facial and lower cranial nerve function. As an optimal goal, completeness of resection with functional Facial nerve preservation is formulated and as an acceptable compromise, near total microsurgical resection with functional Facial nerve preservation is suggested. In the background of a multisurgeon, resource constrained setup an acceptable level of complications and a reasonable outcome can still be achieved. The necessity of intraoperative cranial nerve monitoring, ultrasonic aspirator and the role of surgeon's learning curve cannot be undermined.

KEYWORDS: Vestibular Schwannoma, Cerebellopontine angle tumour, symptoms, surgical outcome, indication, facial nerve.

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INTRODUCTION: OBJECTIVE: To highlight the pattern of clinical presentation and surgical outcome of Vestibular Schwannomas [VS] in our institutional experience with particular emphasis on extent of tumour removal, postoperative Facial Nerve outcome and postoperative complications in the background of multisurgeon teaching hospital [with various levels of learning curve] and a resource constrained setup [unavailability of ultrasonic aspirator and intraoperative cranial nerve monitoring].

METHODS: A retrospective analysis was done using available Discharge summary database. Clinical assessment was done using House Brackmann grading for facial nerve function,[1] pure tone audiometry for hearing and MRI Brain imaging [Figures 1]. Size of the tumour was taken as the maximum transverse diameter demonstrated on contrast enhanced MRI brain. All except 1 patient underwent retromastoid retrosigmoid suboccipital craniectomy. Patients were placed in supine position with head turned to contralateral side and fixed with Sugita head frame [Figure 2]. Retromastoid C shaped incision was taken to reflect suboccipital muscles and overlying fascia and subcutaneous tissue as a single layer. Suboccipital craniectomy was done to expose transverse sinus, sigmoid sinus and their junction. Foramen magnum rim was opened electively. Mastoid air cells were packed with muscle/abdominal fat and bone wax. Initial small dural opening was done in the inferior part to expose and drain CSF from cerebello medullary cistern.

The dura was opened based on Transverse and Sigmoid sinuses. Self-retaining retractors were intermittently applied to optimally retract the cerebellar hemispheres. After adequate CSF drainage from the CP angle and adjoining cisterns, intratumoural decompression was done strictly staying within the arachnoid planes, using suction apparatus, sharp scissors, ring curette and tumour knife. After achieving significant tumour decompression, tumour capsule became lax and collapsible which was separated from the surrounding neurovascular structures under magnification of operating microscope. Intrameatal component of tumour was delivered after drilling the internal auditory meatus using high speed diamond burr. Finally, the tumour adjacent to the brain stem was delivered after ensuring minimal handling or traction. Patient was closely monitored for fluctuations in Heart rate and B.P; Ultrasonic aspirator, intraoperative facial and lower cranial nerve monitoring was not available. Hemostasis was confirmed by achieving normotension and valsalva manouevre. Water tight dural closure was achieved by using pericranial graft or temporalis fascia graft for closure. The craniectomy defect was sealed by replacing bone dust and bone chips. Postoperative CT scan was done either immediate postop or electively after 48 hours depending on the patient's neurological status.

RESULTS: A total of 110 patients who were entered in the discharge summary database between January 2004 to April 2010 were included in the study. Headache was the most common presenting symptom [65.4 %] [Table 1]. Hydrocephalus was present in 45.4 % of patients out of which 34.5 % required perioperative CSF diversion procedure. Papilloedema was present in 38.2 % of patients. 21 % patients presented with preoperative lower cranial nerve palsy. The mean tumor size was 4.4 cm. Giant tumours [>4 cm] constituted 74 % of patients [Figure 3]. Only 6 % [n=6] tumours were < 3 cm in size. Cystic Vestibular schwannomas [> 50 % tumour having cystic component] constituted 27 % [n=30]. 4 % [n=5] of patients had bilateral vestibular schwannomas. All patients [except 1 case of translabyrinthine approach] underwent Retrosigmoid retromastoid suboccipital craniectomy.

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Neurosurgeon's familiarity as well as the advantage of being able to treat virtually any size tumour by this approach were the reasons for choosing this approach. In 80 % of cases, gross total tumor resection was achieved. In 20 % of cases, deliberate subtotal resections were performed [Figure 4]. These were due to adhesions to brain stem in 4 % cases and for facial nerve preservation in 5% cases. Small residues were left attached to lower cranial nerves in 8% [n=10] and trigeminal nerve in 3% [n=4] cases. 6.3% [n=7] were recurrent vestibular schwannomas with a mean recurrence duration of 42.1 months.

All patients had significant preoperative hearing loss [Class C & D of American Academy of Otolaryngology-Head and Neck Surgery Foundation hearing classification system].[2] 57.3 % [n=63] had significant [House Brackmann grade 3-6] preoperative facial nerve palsy out of which 61 patients had > 4 cm tumour [Table 2]. Anatomic facial nerve preservation was achieved in 84 % in tumours < 3 cm size. The overall anatomic facial nerve preservation rate was 33.6 %. The rate of functional facial nerve preservation [H-B Grade 1-2] was 67.2 % in cases of small tumors (< 30 mm). The overall functional facial nerve preservation [H-B Grade 1-2] was 28.2 %. Only 52.7 % [n=58] were available for followup [at 6-12 months] [Figure 5]. The Facial nerve functional status at follow up was almost comparable to the immediate postop status. However the veracity of this finding may not be tenable due to the significant followup drop-out rate.

Postoperatively 71.9 % patients had Facial Nerve palsy [House Brackmann Grade 3-6] out of which 57.3 % preoperative facial nerve palsy and 14.6 % had new onset facial nerve palsy. Postoperative lower cranial nerve palsy was present in 33.6 % out of which 23.6 % had preoperative palsy and 10 % had new onset palsy. Postoperative CSF leak was present in 11.8 % patients. Overall mortality was 5.4 % [6 cases] out of which 4.5 % [5 cases] were due to operative site haematoma.

DISCUSSION: The study of Vestibular schwannoma by the medical fraternity started as early as in 1777, when Sandifort described the post mortem findings of a case of "Acoustic Neurinoma".[3] In 1917, Cushing described the intracapsular debulking of Vestibular schwannomas, which reduced the operative mortality from 35% to 10%.[4] In 1941, Dandy reported a mortality rate of 10.87% after complete removal of 46 acoustic neuromas.[5] In Professor Samii's last 200 vestibular schwannoma operations, complete tumor removal was achieved in 98% of patients. Anatomical preservation of the facial nerve was possible in 98.5% of patients. In patients treated for tumors with extension Classes T1, T2 and T3, the rate of facial nerve preservation was 100%. The overall rate of functional hearing preservation was 51%. The mortality rate was 0%.[6] In our study, all included patients presented with significant hearing loss [Class C & D of American Academy of Otolaryngology-Head and Neck Surgery Foundation hearing classification system].

The trend was comparable to a similar study from Jain et al.[7] which is from a comparable setup from this part of the world. Jain et al., had 90 % of the patients presenting with significant hearing loss preoperatively. Preoperative facial nerve palsy [H-B Grade 3-6] was seen in 57.3 % of our patients. This might be attributed to the relatively larger size of tumours in our series [74 % cases being > 4 cm in diameter]. Although the overall anatomical facial nerve preservation rate was only 33.6 % in our series, in smaller sized tumours [<3 cm: 84 %, 3-3.9 cm: 90 %] it was comparable to series by Jain et al., [81.3 %]. This might be attributed to many factors like multiple surgeons with various levels of learning curves, larger size of tumours and unavailability of intraoperative cranial nerve monitoring and ultrasonic aspirator.

In our series, gross total excision could be achieved only in 80 % of cases as safe removal of residue was not found to be possible due to adherence to vital neurovascular structures in the remaining 20% of cases. Lower cranial nerve palsy was seen in 33.6 % of patients postoperatively out of which 23.6 % of patients had significant lower cranial nerve palsy preoperatively. Effectively there was an increase by 10 % of lower cranial nerve involvement postoperatively which was comparable to other series [Table 3]. In our series, the mortality was 5.4 %, which was comparable to that of Jain et al. Misra et al., had 39% of cases with > 4 cm tumour and 96% anatomical Facial Nerve preservation.[8]

CONCLUSION: Hearing loss is the main presenting symptom of vestibular schwannoma. The indication and the timing of tumor resection is dependent on the tumor extension and related necessity of brain stem decompression and on the auditory function. The chances of good outcomes [Facial nerve preservation and post op morbidity] are best when surgery is performed early [smaller size tumours] and when there is good preoperative facial and lower cranial nerve function. As an optimal goal, completeness of resection with functional Facial nerve preservation is formulated and as an acceptable compromise, near total microsurgical resection with functional Facial nerve preservation is suggested.

In the background of a multisurgeon, resource constrained setup an acceptable level of complications and a reasonable outcome can still be achieved. The necessity of intraoperative cranial nerve monitoring, ultrasonic aspirator and the role of surgeon's learning curve cannot be undermined.

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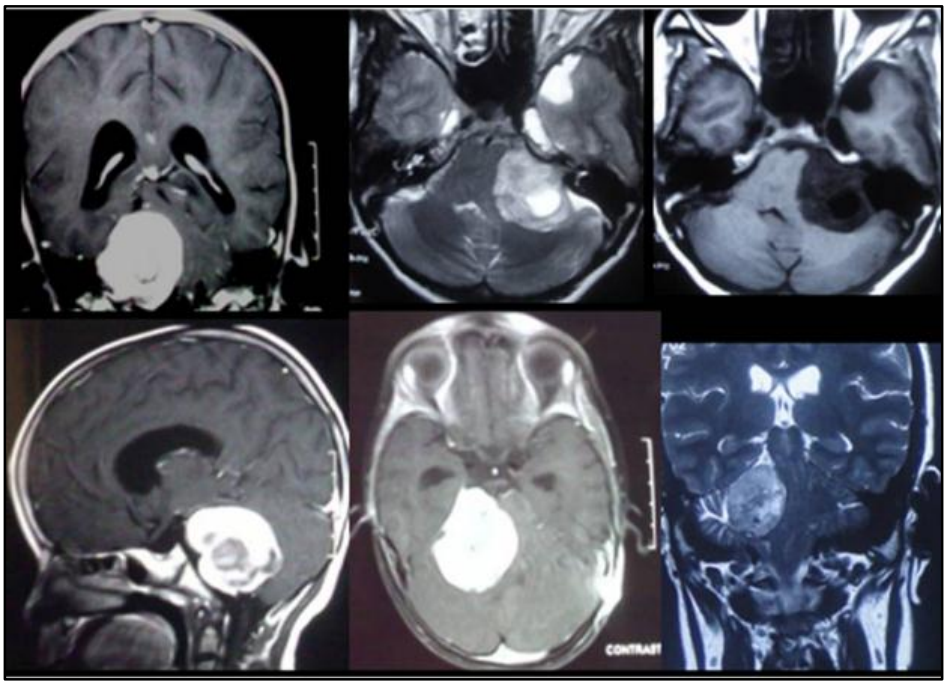

Fig. 1: Preoperative MRI imaging sequences showing tumour characteristics of Vestibular schwannoma

Fig. 2: Showing positioning and incision [broken white line] in a patient undergoing Retromastoid suboccipital craniectomy for Vestibular schwannoma

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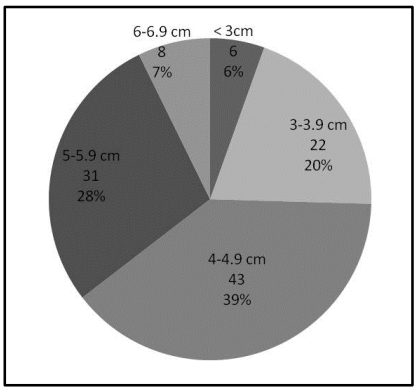

Fig. 3: Showing distribution of Vestibular schwannomas as per tumour size

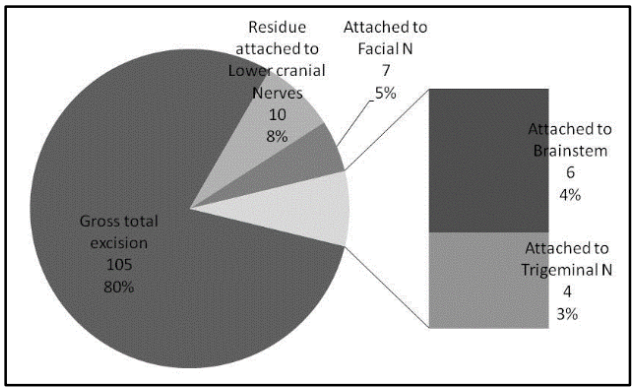

Fig. 4: Showing extent of tumour resection in Vestibular schwannoma

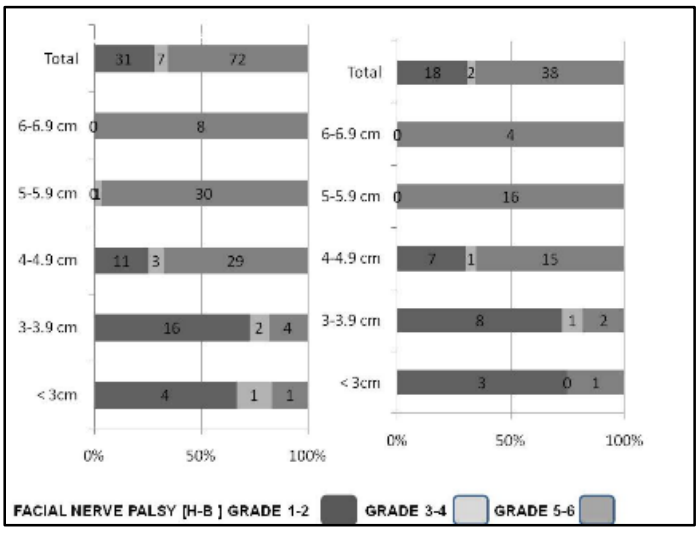

Fig. 5: Showing comparison of outcome of facial nerve function at immediate postop and at follow up in vestibular schwannoma

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Sl. No.	Clinical parameter	No. of patients	%
1	Hearing impairement	110	100
2	Headache	72	65.4
3	Facial nerve weakness	59	53.6
4	Hydrocephalus	50	45.4
5	Papilloedema	42	38.2
6	Lower cranial nerve palsy	23	21

Table 1: Showing Clinical profile of presentation in Vestibular schwannoma

Tumour size	< 3cm	3-3.9 cm	4-4.9 cm	5-5.9 cm	6-6.9 cm	Total
No.	6	22	43	31	8	110
Preop Facial N palsy Grade 3-6	0	2	25	29	7	63[57.3%]
Preop Intact Facial N function	6	20	18	2	1	45[43.7%]
Anatomical Facial N preservation	5 [84%]	18[90%]	14[77.8%]	0	0	37[33.6%]
Immediate Postop Facial N palsy Gr 1-2	4[67.2%]	16	11	0	0	31[28.2%]
Immediate Postop Facial N palsy Gr 3-4	1	2	3	1	0	7[6.4%]
Immediate Postop Facial N palsy Gr 5-6	1	4	29	30	8	72[65.5%]
Followup Facial N palsy Gr 1-2	3	8	7	0	0	18[31%]
Followup Facial N palsy Gr 3-4	0	1	1	0	0	2[3.4%]
Followup Facial N palsy Gr 5-6	1	2	15	16	4	38[65.5%]

Table 2: Showing corelation of tumour size and postop facial nerve function in vestibular schwannoma

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Comparison of present study with contemporary Literature	M Samii et al.,[6] 2000-2003 [n= 200]	B K Misra et al.,[8] 2005-2008 [n= 100]	V K Jain et al.,[7] 1988 – 2002 [n=259]	Present Series 2004-2010 [n=110]
Giant tumours [> 4cm]	Class T4= 46%	39 %	56 %	74 %
Anat 7thN Preservn	98.5%	96%	79.2 %	33.6%
Gross Total excision	98%	83 %	96.5 %	80 %
CSF Leak	2.5 %	9%	4 %	11.8%
Hydrocephalus	1.5%	-	-	25.4%
Hemorrhage	1 %	-	2.4 %	4.5%
Lower Cranial N palsy	1.5 % [preop 1.5%]	8% [preop 7%]	6.8 % [preop 34.3%]	33.6 % [preop 23.6%]
Mortality	0 %	0%	6 %	5.4%
Intraop 7th N monitoring	Yes	Yes	No	No
Ultrasonic Aspirator	Yes	Yes	+/-	No

Table 3: Showing comparison of present series with contemporary Literature

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