Assessment of Endoscopic Assisted Microsurgery in Treatment of Cerebellopontine Angle Lesions

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ABSTRACT

Background: The use of the endoscope can compensate for the deficiencies of the microscope which are the reduction of light intensity in the depth of the operating field and lack of wider viewing angles. Objective: to assess the effectiveness of endoscopic assisted microsurgery in the treatment of cerebellopontine pathologies. Methods: A prospective descriptive clinical study of surgical management of 25 patients with cerebellopontine angle pathologies was done in Suez Canal University Hospital; from January 2008 until August 2010. A rigid endoscope was used with both angles the zero° and 30°. Results: Complete tumor removal achieved in 85.7% with recurrence in (6.25%). In 24%, opened air cells and in 16% residual tumors were seen only with the endoscope. The facial and auditory nerves were left intact after the procedure in 92% and 80% respectively. In 40%, the vessel causing trigeminal neuralgia and final microvascular decompression and Teflon insertion were properly achieved with the endoscope. The operative time added by endoscope ranged from 15 to 45 minutes. Complications occurred in 36% of patients, but most of them were simple and recoverable with no intraoperative mortality. Postoperatively 24% had increased facial weakness most of them improved during follow up, 20% showed increased hearing deficits. The facial nerve preservation and hearing preservation were increased by the use of the endoscope. Conclusion: Endoscopic assisted microsurgery for treatment of cerebellopontine angle (CPA) pathologies is effective and safe procedure ensuring surgical success with less postoperative morbidity. [Egypt J Neurol Psychiat Neurosurg. 2012; 49(2): 93-98]

Key Words: Cerebellopontine Angle, Endoscopic Assisted Surgery, Vestibular Schwannomas, Trigeminal Neuralgia, and Microvascular Decompression.

INTRODUCTION

The most common Cerebellopontine angle (CPA) tumour is schwannomas, followed by meningiomas, and epidermoid cysts. The other tumours are rare. Non-tumorous pathologies are trigeminal neuralgia (TN), hemifacial spasm (HFS), and glossopharyngeal neuralgia. Clinically, CPA lesions may present with cranial nerves dysfunction, cerebellar and/or brainstem compression, raised intracranial pressure (ICP), and /or localized or non-localizing headache. Magnetic resonance imaging (MRI) is the first method for diagnosis of CPA tumors. Computerized Tomography (CT) is more useful for bony structures evaluation and for the description of the relation of the tumour to internal auditory canal (IAC). The goals of treatment of CPA lesions are avoiding mortality, preventing progressive neurological disability, minimizing treatment complications, and maintaining regional cranial nerve function. Endoscopic procedures of the CPA provide increased visualization of the CPA without retractor, identification of neurovascular structures ensuring surgical success with less postoperative morbidity and decreased length of stay. For MVD, it provides a more comprehensive evaluation of the completeness of microvascular decompression (MVD). Insertion of the endoscope in CPA should be preferably done under control of operating microscope. The endoscope has some disadvantages as unavailable instrumentation designed specifically for endoscopy of CPA, potential thermal injury and lack of three dimensional (3D) vision. The aim of this work is the assessment of the effectiveness, safety, and advantages of the use of endoscope during microsurgical management of CPA pathologies.

PATIENTS AND METHODS

This is a prospective descriptive clinical study of 25 patients diagnosed as having CPA pathology. The data were collected from the department of neurosurgery, Suez Canal University Hospital, Ismailia, Egypt, from January 2008 to August 2010. The patients were subjected to neurological examination, facial nerve VII function grading (House-Brackmann (HB) grades), pure tone audiometry and speech discrimination score according to Gardner and Robertson’s classification as grades from I to V.
Patients were investigated by CT and MRI without and with contrast. Tumors in the CPA were categorized as small (<15 mm), medium (15–30 mm), large (30–40 mm), and giant (>40 mm)\(^1\).\(^2\).\(^3\).\(^4\). Tumor extension was evaluated according to Hauksson classification (Table 1)\(^5\).\(^6\).\(^7\). Endoscopic Instruments: rigid endoscopes (Hopkins) telescope 4 mm diameter, 18 cm length, 0 and 30 degrees, irrigation systems, endoscope holding arm, light source, Coupled Charged Device (CCD) camera, monitor, and video recorder. All patients were managed using a standard microscopic retrosigmoid approach. For MVD a small Teflon patch was used.

**First endoscopic survey:** The endoscope was introduced into the CPA under microscopic guidance aiming at observation of the CPA contents and tumor borders, here it is considered beneficial. **Second endoscopic survey:** aimed at confirmation of total tumor excision, full MVD, closure of opened air cells at the IAC, and report of cerebellar contusion. It is then considered beneficial. Assessment of Outcome: For TN and HFS: Clinical improvement was categorized according to Barrow Neurological Institute for pain intensity score (Table 2)\(^8\).\(^9\).\(^10\). Postoperative MRI was done. Postoperative complications were reported.

**Table 1.** Hannover Classification of cerebellopontine angle vestibular schwannoma extension.\(^1\)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Tumor extension</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Tumor is purely intrameatal</td>
</tr>
<tr>
<td>T2</td>
<td>Tumor is intra- and extra-meatal</td>
</tr>
<tr>
<td>T3a</td>
<td>Tumor is filling the cerebellopontine angle cistern</td>
</tr>
<tr>
<td>T3b</td>
<td>Tumor is reaching the brain stem</td>
</tr>
<tr>
<td>T4a</td>
<td>Tumor is compressing the brain stem</td>
</tr>
<tr>
<td>T4b</td>
<td>Tumor is severely dislocating the brain stem and the fourth ventricle</td>
</tr>
</tbody>
</table>

**Table 2.** Barrow Neurological Institute pain intensity score after MVD for TN.\(^1\)

<table>
<thead>
<tr>
<th>Score</th>
<th>Pain relief</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>No pain, off medications</td>
</tr>
<tr>
<td>II</td>
<td>Occasional pain, off medications</td>
</tr>
<tr>
<td>IIIa</td>
<td>No pain, continued use of medications</td>
</tr>
<tr>
<td>IIIb</td>
<td>Pain persists, but adequately controlled with medications</td>
</tr>
<tr>
<td>IV</td>
<td>Pain not adequately controlled with medications</td>
</tr>
<tr>
<td>V</td>
<td>No relief</td>
</tr>
</tbody>
</table>

**RESULTS**

Patients age ranged from 21 to 61 years with a mean/SD of 45±11.02 years. There were 12 (48%) males and 13 (52%) females. There were a 12 patients with VS, 4 patients with meningiomas, 3 patients with epidermoid, 3 patients with TN, and one patient with each of arachnoid cyst, metastasis, and HFS. The duration of symptoms ranged from 2 months to 30 months with a mean/SD of 10.2±8.59 months. Headache was the most frequent symptom in 40%. Sensory Neural Hearing loss (SNHL) was present in 44% of patients, facial paralysis in 16%, facial hypoplasia in 20%, and lower cranial nerve affection in 8%. Hydrocephalus in 12% and managed by ventriculoperitoneal shunt. Regarding the 12 patient with VS, seven tumors were giant, four were large, and one was medium. According to the Hannover grading, five tumors were grade T3b, another five were T4a, one was T3a, and another one was T4b. Eight patients had widening of the IAC, four had cystic changes in their tumors, and all the patients showed enhancement of their tumors after injection of gadolinium contrast either homogeneously in seven or heterogeneously in five. Four patients with meningiomas, two were medial to the IAC, one lateral to it, and one superior to it. One meningioma was medium sized, two were large and one was giant tumor. In patients with TN, no abnormalities were detected in MRI, while in HFS, MRI and MRA revealed the basilar artery compressing VII nerve. First survey was completed in 84% and aborted in 16%. It was beneficial in 80%. Second survey was tried in all patients except one and was beneficial in 96%. Tumor debulking before endoscopic insertion was needed in 81%. The VII and Vestibulocochlear (VIII) nerves were endoscopically visible in first survey in 64% and 48% respectively. In patients with VSs, the VII nerve was visible in only 41.7%. During second endoscopic survey: the VII and VIII nerves were anatomically intact in 92% and 80% respectively. There were 24% of patients in whom opened air cells were seen only with the endoscope and in 16% residual tumors were present and seen with the endoscope (Figure 1). The time added by endoscope ranged from 15 to 45 minutes with a mean and SD of 29.4±8.3 minutes. The mean operative time added by endoscope increased with increasing tumor size in schwannomas. **Complication:** The overall complication occurred in 36% (9 of 25) of patients, but most of it was simple and recoverable. Two complications were related to the endoscope (8%): increased VII nerve weakness and cerebellar ataxia.

**Outcome of the Study:** The endoscopic view of completeness of tumor removal was the same as the radiological outcome immediate postoperative. Total tumor removal achieved 17 and incomplete removal in three. There was one case of recurrence in a patient with meningioma. **Cranial nerve outcome:** Postoperatively in the 25 patients, six had increased facial weakness, after one year follow up, five of them improved and one remained the same. Four patients showed increased hearing deficits postoperatively and
not improved. Outcome in TN (Figure 2). There were 3 patients presented with TN, two of them were improved completely and became free of medications (grade I) and one patient improved but still in need for some medications (grade II). Patient with HFS: The compressing vessel was a tortuous basilar artery, Teflon patch inserted properly with both the endoscope and microscope.

**Figure 1.** Vestibular schwannoma before (left) and after (right) total endoscopic excision with the facial nerve intact.

**Figure 2.** Endoscopic MVD for TN, before (left) and after (right) Teflon insertion by the endoscope.

**DISCUSSION**

By identifying anatomic windows, the endoscope allows us to perform surgery through smaller exposures, with less brain retraction\(^1\). The duration of symptoms in our series ranged from 2 months to 30 months. Ewa et al. reported a clinical history ranged from 3 months to 22 years, with average duration of symptoms was about three years\(^1\). This is the case in other different studies discussing the clinical presentation of VSs with some difference in figures due to difference in tumor size or patient’s number\(^16,17\). Regarding TN and in contrast to our results, Aryan fount that in a 19 patients with TN, in high resolution thin cuts MRI, the compressing vessel seen by in 17 patients\(^18\). In another series by Fukuda et al, MRA correctly identified offending vessels in 14 (67%) of the 21 TN and 34 (87%) of the 39 HFS patients\(^19\). This difference in detecting the compressing vessel can be explained by the usage of MRI brain in our patients while the others using MRI posterior fossa.
Regarding the 12 patients with VSs, seven of them have giant VSs. Our results regarding the size of the tumor differ from that in the literature as our patients usually presents lately than reported in other series, in addition to the smaller number of patients. In the large series of Matthes and Samii in 1000 of patients, tumor extension analysis showed that 3% of tumors belonged to Class T1, 17% to Class T2, 44% to Class T3, and 36% to Class T4. Gornley et al in a series of 179 VSs found that, 37% of the tumors were small, 47% as medium, and 16% as large. Park et al found that, the most common type of VS was mixed solid and cystic nature in 26 patients (52%), followed by solid form in 20 (40%) and totally cystic form in only 4 (8%). The incidence of the cystic variety depends on the percentage of large tumours making up the series. Voss et al in 40 patients with CPA meningiomas found the most common site of dural origin to be anterior to the IAC in 26%, posterior 21%, superior 18%, and inferior 16%. Operative data: Wackym et al found that; in 19 of 68 patients (28%) exposed air cells were not seen with the microscope during retrosigmoid approaches but were identified endoscopically. Gerganov et al. used the endoscope in large VSs and found that an initial tumor debulking to be performed. During endoscope-assisted MVD for TN, gentle retraction of the cerebellum, release of CSF from the basal cisterns, and lysed of the arachnoid bands was the role in all cases in the series of Teo et al and others. These results matched with our results but our results are less promising due to our early experience with the endoscope, larger size of tumors and unavailability of cranial nerve monitoring. The VII & VIII nerves were clearly visible with the endoscope during first survey in all patients with epidermoid cyst, arachnoid cyst, TN, and HFS. They were visible in 75% of the patients with meningiomas, and in 41.7% for the VII nerve and in 8.3% for the VIII nerve. The VII & VIII were anatomically intact in 92% and 80% during second survey respectively. There were six patients (24%) in who opened air cells were seen only with the endoscope. There were five patients (20%) in whom residual tumors were detected only with the endoscope. Kabil and Shahim in a series of 112 fully endoscopic resections of VSs found anatomical preservation of the facial nerve in all of the patients and of the cochlear nerve in 83/101 (82%) of hearing ears. Similar findings were reported by Hori et al. and Moriyama et al. and Gerganov et al. These results are matched with our results with some differences due to learning up curve of endoscopic assisted surgery and the radiological characters of the lesions in our series. In patients with TN operated microscopically, Li et al. reported that, complete MVD was achieved in 80.6% whereas when done endoscopically a more than 95% achievement in Teo et al. In our study, the operative time added by endoscope ranged from 15 to 45 minutes. Previous studies mentioned that, endoscopic procedures added an average time of 15 to 30 minutes to the duration of surgery during endoscopic assisted MVD or large VSs. Completeness of tumor excision: Of the 21 patients with mass lesions, complete removal achieved in 18 (85.7%). Wackym et al. reported more than 96% success of complete tumor excision. In a series of 178 VSs found that, only one patient (0.6%) underwent an incomplete tumor resection, and similar figures were reported by Gerganov et al. These results are matched with our study and both document the benefit of the endoscope in achieving complete tumor excision. Tumor remnant after total microsurgical removal are detected by the endoscope in 0 – 17.6% in different series. Most of previous studies document the importance of endoscope in reducing the need for cerebellar retraction and CSF release to totally remove the tumors. In agreement to previous studies, there were no added facial or auditory deficits in our patients with TN, HFS, and arachnoid cysts. In the patient with medium sized VS, no hearing or facial weakness complicate the course of the patient. As the VSs increase in size, more injury to the VII and VIII nerves occurred. Gökkuş et al. in a series of 32 VSs found that postoperatively, six patients suffered from grade II facial weakness, 2 from grade III, and one from grade IV, with all other patients having grade I facial function. In 32 patients Hori et al. achieved anatomical preservation of the facial nerve in 31 cases, and damage of the facial nerve by the endoscope was met once. Overall these findings are more or less similar to our findings but comparison with those of larger series is difficult because there are no uniform criteria for categorizing surgical results and we have no cranial nerve monitoring during CPA surgeries. Outcome in TN: In our three patients complaining of TN, two were improved completely and became free of medications (grade I) and one patient improved but still in need for some medications (grade II). Similar results were reported by Kablı et al. and Ramin et al. Our number of patients is not comparable to these series. Complication: Nine patients (36%) have a complicated postoperative course. Wackym et al. reported negligible complications in 2 of their series. In 1,177 cases of endoscope assisted minimally invasive retrosigmoid approach, the most common complication was CSF leakage, encountered in 3.6% cases. Other series reported equal figures of complications. In our study there was a slight trend suggesting more frequent CSF leak with cases of larger tumors, but the number is small for a definitive statistical conclusion. Two complications were related to the endoscope (8%). There were no complications related to the use of the endoscope in many previous studies. Recurrence: There was one case of
recurrence in a patient with meningioma. Yuguang et al in a series of 28 endoscopic assisted CPA surgeries reported that, no recurrences in patients with tumors, and all TN patients cured.

Accurate comparison with other studies is difficult due to differences in follow up periods and number of the patients. We have no mortality in our study which is the result also in most of other endoscopic studies.

In a comparative study between the endoscopic and microscopic MVD, the mortality rate was zero for endoscopic group and ranged from zero to 1.4% in microscopic group.

We followed our patients from a minimum of 2 months to a maximum of 30 months. This period is short as more recurrence can appear at a delayed times. Cheng et al in a 32 patients underwent endoscope-assisted MVD or fully endoscopic MVD for HFS, the procedure was successful in 96.9%.

Conclusion

Endoscopic assisted microsurgery for treatment of CPA pathologies is effective and safe procedure that provide increased visualization without retractors, ensuring surgical success with less postoperative morbidity. Some benefits of endoscope use in the CPA have been revealed, as better control of total tumor excision, decrease the cranial nerve injuries, and improved visualization, identification of neurovascular structures, and extensive drilling of the posterior portion of the IAC.

[Disclosure: Authors report no conflict of interest]

REFERENCES


The Arabic abstract

تقييم الجراحة المجهرية بمساعدة المنظار في علاج أفات زاوية المخيخ والقنطرة

لتقييم الجراحة المجهرية بمساعدة المنظار في علاج أفات زاوية المخيخ والقنطرة تم دراسة 25 مريض باستخدام المنظار الصلب وكان معظم المرضى من البالغين. تم استعمال الروم كليا في 85.7% وكان هناك ارتفاع للروم في 12.5%. في 3% من المرضى لم تكن هناك حاجة لأعادة المجهرية. في 24% من المرضى، شهدت خلال الجراحة المفتوحة فقط بالمنظار، في 12% من المرضى كانت هناك أرمون متقيبة شهدت فقط مع المنظار. في 40% لم يرى الأشخاص الضباث عن العصب إلا بالمنظار. في 50% كان ضغط الأشخاص الضباث على العصب بمساعدة المنظار. في 40%، تم علاج جميع حالات المبسطة الثلاثي التوليد وتقلص شق الوجه، حددت مضاعفات في 2% من المرضى ولكن كانت أصغرها كانت بسيطة وتم علاجها، لذا تم علاجها، لذا تم علاجها، لذا تم علاجها، لذا تم علاجها، لذا تم علاجها، لذا تم علاجها، لذا تم علاجها. بعد الجراحة تأثرت وظيفة العصب الوجه ب 24% مع معظمهم تحتد بالنسبة وتأثرت فوق السع في 5% بعد الجراحة. الجراحة المجهرية بمساعدة المناظير لعلاج أفات زاوية المخيخ والقنطرة فعالة وأمنة وتتوفر مزيدا من الرؤية دون الحاجة إلى الإبعاد الشديد للمحافظ.