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The endoscopic-assisted approach versus the microscopic only approach in resection of cerebellopontine angle epidermoids: a 5-year retrospective study

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Abstract

Background: The endoscopic-assisted technique has been utilized with various intracranial lesions with many approaches. In the cerebellopontine angle (CPA), the technique has been used to combine the benefits of the operating microscope and the endoscope. In this study, we highlight the use of the endoscopic-assisted technique in resection of CPA epidermoid tumors to ensure a total resection, decrease complications and protect the neurovascular tangles.

Results: In the endoscopic-assisted group, only 18.8% of the patients had post-operative residual in the post-operative MRI. However, in the microscopic only group 56.3% of the patients had post-operative residual. Consequently, there is a statistically significant difference regarding the post-operative residual between the two groups.

Conclusions: The endoscopic-assisted approach is superior to the microscopic only approach in the excision of CPA epidermoids and minimizing the post-operative residual and the recurrence.

Keywords: Endoscopic-assisted technique, Cerebellopontine angle, Epidermoid tumor, Microscopic only

Background

The introduction of the microscope in neurosurgery has been established for more than three decades. This led to a major improvement of the outcome as well as the extent of tumor resection. The microscope provides an excellent wide 3D view with sufficient magnification to deal with the deepest lesions in the brain and skull base [1]. However, in narrow and angled regions, there is a significant loss of visualization of these areas [2].

These shortcomings of the operating microscope rose the need of combined use of microscopic and endoscopic techniques in the surgical procedures which led significantly to the improvement of surgical outcome. The endoscopic-assisted technique has many advantages in

the control of different lesions via many approaches. The endoscope has a different view in comparison with the microscope. A wide-angle viewing field can be produced. Therefore, even lesions which are not located in front of the endoscope can be detected early [1].

The utilization of hybrid technique in neurosurgical approaches has contributed significantly to the improvement of surgical outcomes. The endoscopic-assisted technique has shown significant advantages in the management of various lesions through different approaches. The disadvantages of endoscopic-assisted technique in the CPA have been illustrated. The defective visualization of the delicate neurovascular structures proximal to its scope in the posterior fossa and the narrow working channels makes the likelihood of injury of these structures high. Moreover, the handling and the precise

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dissection through the endoscope is not straight forward comparing with the microscope [3].

In this paper, we report on the use of a combined microscopic–endoscopic surgical technique versus the microscopic only approach in excision of the CPA epidermoids. The epidermoid cysts have a creeping manner of growth and prefer to grow in the corridors, canals, between neurovascular complexes and in many cases, they reach the middle cranial fossa. As a result, we predict that the hybrid technique would be of great value in controlling these lesions.

Methods

A sample size of 32 patients selected according to inclusion criteria (patients with CPA epidermoid) and exclusion criteria (recurrent cases, cases with missed data) were divided into 2 groups: one group (16 cases) who had endoscopic-assisted craniotomies (using microscope with assistance of surgical endoscope) (Karl Storz endoscope, Inc., Tuttlingen, Germany) and the other group (16 cases) had only microscopic excision (microsurgical operating system MÖLLER 20–1000, Germany) in the period between 2017 to 2021. Ethical approval was obtained from the research ethical committee of Assiut university hospital. All patients were carefully examined and assessed by pre- and post-operative CT and MRI brain. The mean follow-up period is 2 years. The results of the two approaches were compared to identify which one has a better outcome in CPA epidermoids excision according to certain outcome measures or if there was no difference in outcomes between the two methods. Ethical approval had been obtained from the ethical committee of the faculty of medicine, Assiut university on 17/3/2017. Informed consent had been signed by all participants.

Statistical Package for the Social Sciences (SPSS) USA was used for all statistical analyses (version 26) 2019. Frequencies and percentages were used to express descriptive data. To investigate categorical variables, Chi-square test was performed. To analyze quantitative variables and determine differences in mean values between the two groups, independent t-test was performed. Statistical significance was determined by P-values of less than 0.05.

Results

The cases were followed up by clinical examination and post-operative CT and MRI brain including diffusion sequences. The mean follow-up period was 2 years. Three patients were lost to follow-up in the endoscopic-assisted group, while in the microscopic only group two patients were lost.

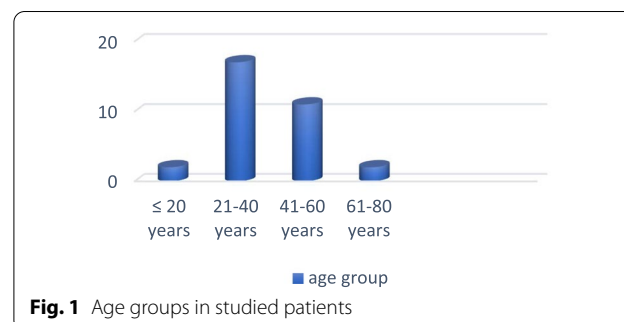
Regarding patient demography, the study enrolled 32 patients divided into 16 patients who underwent

endoscopic-assisted surgery, while the other 16 patients underwent microscopic only surgery, who presented to the neurosurgery clinic. Majority (59.4%) of the studied patients were females. Mean age of enrolled patients was 42.91 ± 11.93 years with a range between 20 and 80 years. Regarding the age group of studied patients, 2 (6%), 17 (54%), 11 (34%) and 2 (6%) patients were ≤ 20 years, 21–40 years, 41–60 years and 61–80 years, respectively (Fig. 1).

Regarding the intra-operative detection of missed parts after introduction of the endoscope in the endoscopic-assisted group, in 62.5% of the patients, residual parts were detected by the endoscope. However, in 37.5% of the patients, no residual was detected. It should be noted that the other 16 patients (microscopic only group) was operated by microscopic only technique which did not include endoscopic inspection (Fig. 2).

In the assessment of post-operative residual in the endoscopic-assisted group, 81.3% of the patients did not have any post-operative residual and 18.8% of the patients had post-operative residual in the post-operative MRI with diffusion study after a mean of 2 years of follow-up. However, in the microscopic only group, 56.3% of the patients had post-operative residual and 43.8% patients did not have any residual. Consequently, there is a statistically significant difference in outcome regarding the post-operative residual between the two groups (Table 1).

In the evaluation of post-operative new facial palsy detection or more deterioration in the endoscopic-assisted group, 75% of the patients did not have not any new post-operative facial palsy; however, 25% of the patients had new facial palsy (4 patients, one was House–Brackmann IV and 3 patients were grade III. In three patients, the palsy was temporary, and one patient had a permanent palsy). On the other hand, in the microscopic only arm, 62.5% of the patients did not have new facial palsy and 37.5% of the patients had new facial palsy (6 patients, 2 were House–Brackmann IV and 4 were grade III. In 5 patients the palsy was temporary, and one patient



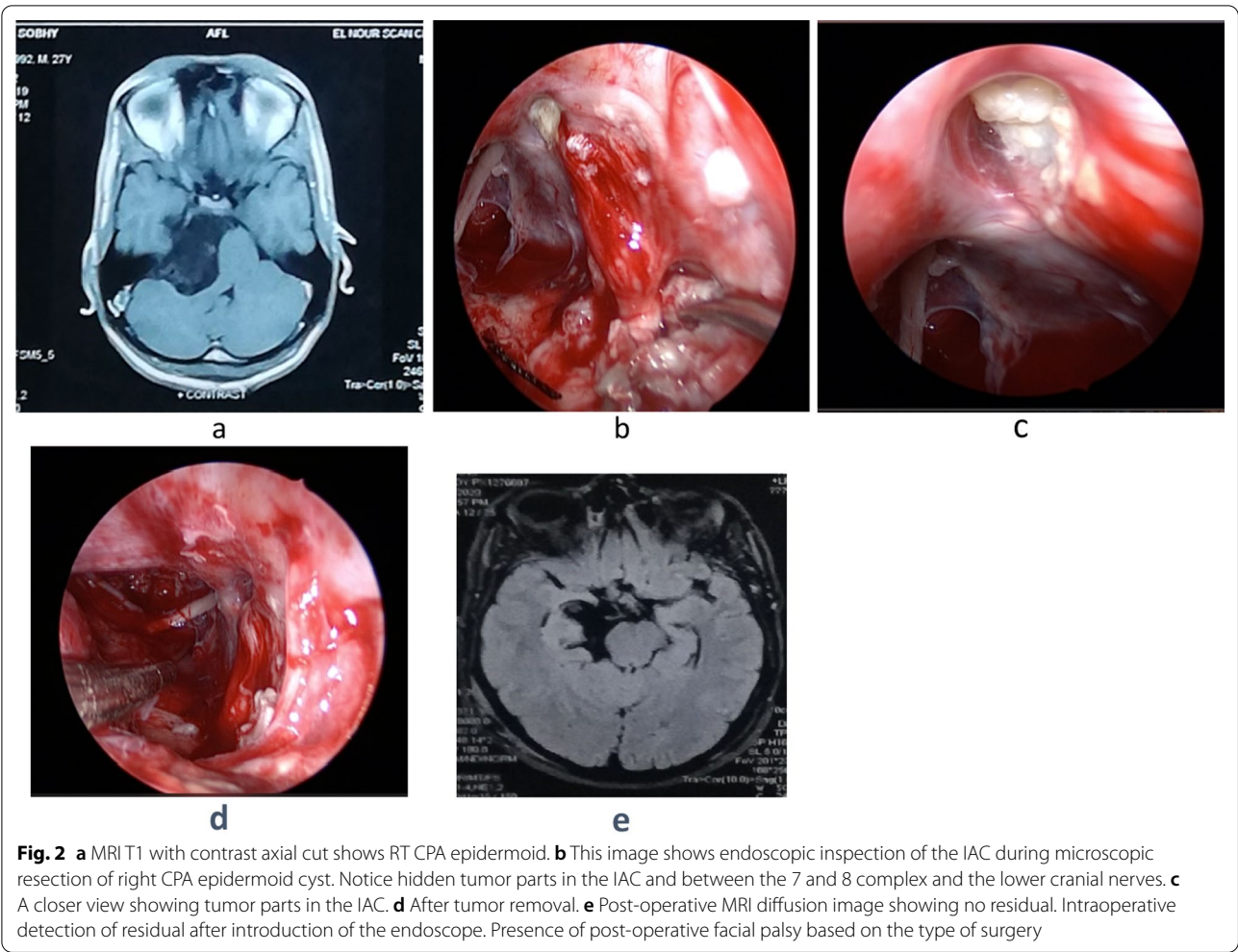


Table 1 Intraoperative detection of residual after introduction of the endoscope

Type of the procedure	Post-operative residual		P value
	Residual	No residual	
Endoscopic assisted	3 patients 18.8%	13 patients 81.3%	0.029
Only microscopic	9 patients 56.3%	7 patients 43.8%	

P value is significant if < 0.05

had a permanent palsy). As a result, after p-value calculation, no statistically significant difference regarding facial nerve preservation between the two groups was detected (Table 2).

In the endoscopic-assisted group, 56% of the patients had operative time equal or less than 5 h and 44% of the patients had operative time between 5 and 7 h. On

Table 2 Presence of post-operative new facial palsy based on the type of surgery

Type of the procedure	New facial palsy		P value
	Post-operative new facial	No post-operative new facial	
Endoscopic assisted	4 patients 25.0%	12 patients 75.0%	0.4
Only microscopic	6 patients 37.5%	10 patients 62.5%	

P value is significant if < 0.05

the other hand, in the microscopic only group, 62.5% of the patients had operative time equal or less than 5 h and 37.5% of the patients had operative time between 5 and 7 h. As a result, there is no significant difference between the two groups regarding the operative time. No mortality occurred in both groups.

Discussion

Epidermoid cysts are histologically benign, grow slowly and account for 0.2% to 1.8% of intracranial tumors [4]. They have the same characters of CSF in T1 and T2 MRI and it is difficult to differentiate them by these sequences. However, they are restricted in diffusion studies [5]. The treatment of choice is surgical resection. Cases with residual tumors have a more likelihood of a septic meningitis and recurrence or progression [6]. Tumor capsule is most important factor that limits total resection of the tumors is the adherence of the capsule to the neurovascular tangles and brain stem, and trials of dissection of the capsule from these structures would bring more risks than benefits to the patients. As a result, it is advisable to leave the capsule behind or a part of it to avoid any permanent cranial nerve palsy. [7]

In the present study, it was noticed that in 62.5% of the patients an intra-operative missed part was detected after introduction of the endoscope. However, in 37.5% of the sample no missed parts were detected. Our study agrees in this context with the study performed by M. Abolfo-toh and colleague which stated that (69%) patients had a “false negative” as residual tumor was found when the endoscope was used. These mutual findings emphasize the utility of the endoscope in visualizing and resecting tumor in microscopic blind spots and around corners [7].

In the present study, in the endoscopic-assisted group, 25% of the patients had new facial palsy. On the other hand, in the microscopic only group, 37.5% of the patients had new facial palsy. Furthermore, after calculating the correlation (*p* value), there is no significant difference in outcome regarding new facial palsy between the two groups. Our findings correlate with other studies which were done by Göksu and his colleagues, and Koerbel and colleagues who used the endoscopic-assisted technique revealed post-operative facial palsy were 22%, 32%, respectively [8]9.

Regarding the operative time, in the endoscopic-assisted group, 44% of patients had operative time equal or less than 5 and 56% of the patients had operative time between 5 and 7 h. On the other hand, in the microscopic only group, 62.5% of the patients had operative time equal or less than 5 h and 37.5% of the patients had operative time between 5 and 7 h. Consequently, after calculating the *p* value, there is no significant difference in outcome between the two groups regarding the operative time.

Review of the literature revealed three papers demonstrate epidermoid cyst excision by the endoscope. Schroeder and colleagues illustrated a series of eight cases with endoscopic-assisted resection of epidermoid tumor, however in only four patients the tumor excision was done under direct endoscopic visualization. They

reported complete resection in three of eight patients and no residual at 12–98 months of follow-up. The rate of new post-operative CN palsy was (37.5%) overall, but much higher in the three patients who had complete resection of the capsule (66.6%) [4].

Safavi-Abbasi and colleagues described their series of 12 patients had endoscopic-assisted removal of CPA epidermoid cysts. They advised not to use the endoscope for resection of the tumors and advocated to use it for only for inspection of the hidden parts and resuming tumor excision by the microscope. They reported a 75% rate of total resection with only 17% of patients developing new or worsened CN paresis. They reported that there was no difference in long-term outcomes when comparing with the earlier series; however, they recommended the endoscope as a good tool for intra-operative visualization and evaluation tumor residual [10].

Finally, Ebner and colleagues [11] demonstrated the endoscopic application in five of seven patients with recurrent epidermoid tumor. They reported a total excision in four of the five patients. Four patients had temporary cranial nerve palsy and one had permanent nerve palsy.

The study includes more than one surgeon who had done the surgeries. This factor may affect the results of the study due to personal difference in surgery and intra-operative opinion. Some patients were lost to follow-up, so we do not have the full image about their disease course.

Presence of a long learning curve to obtain the skills regarding appreciation of the 2D image of the endoscope and how to hold it while using other instruments during dissection or coagulation are some of the difficulties in the scope of the endoscopic surgery in general. This affects our outcome at least in the first few cases.

Conclusions

Based on our study results, endoscopes can be used safely during surgery of CPA epidermoids. As an adjunct to the operative microscope, this modality has a role in reducing the incidence of the post-operative residual.

These recommendations are based on the superiority of the endoscopic-assisted technique over the microscopic approach in the detection of intra-operative missed lesion in canals, corridors and structure of the posterior fossa.

Abbreviations

IAC: Internal auditory canal; MRI: Magnetic resonance imaging; CN: Cranial nerve; CPA: Cerebellopontine angle; CT: Computed tomography.

Author contributions

MT collected the cases, interpreted the data and finalized the results regarding the comparison between the endoscopic-assisted and the microscopic

groups. MK compared endoscopic-assisted approach with other approaches. HMM Interpreted the limitation of endoscopic-assisted technique for epidermoid. RK performed the post-operative follow-up of the epidermoid cases. All authors read and approved the final manuscript.

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Availability of data and materials

All research data are available, and we can share them with the *Egyptian Journal of Neurology, Psychiatry and Neurosurgery*.

Declarations

Ethics approval and consent to participate

The study was approved by the ethical committee of the faculty of medicine, Assiut university on 17/3/2017. All the patients in the study agreed to participate and share their information for medical research. Informed consent was signed by the participants.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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