DOI: 10.4274/gulhane.galenos.2022.55707
Gulhane Med J 2023;65:31-8

Endoscopic resection of intracranial dermoid and epidermoid tumors from a minimally invasive perspective

Adem Doğan[1], Mehmet Ozan Durmaz[2], Ahmet Murat Kutlay[2], Sait Kayhan[3], Şahin Kırmızıgöz[4], Mehmet İlker Özer[5]

[1]*Sehitkamil State Hospital, Clinic of Neurosurgery, Gaziantep, Türkiye*

[2]*University of Health Sciences Türkiye, Gülhane Training and Research Hospital, Clinic of Neurosurgery, Ankara, Türkiye*

[3]*Viransehir State Hospital, Clinic of Neurosurgery, Sanliurfa, Türkiye*

[4]*Dr. Ersin Arslan Training and Research Hospital, Clinic of Neurosurgery, Gaziantep, Türkiye*

[5]*Dr. Nafiz Korez Sincan State Hospital, Clinic of Neurosurgery, Ankara, Türkiye*

Date submitted:
06.11.2022
Date accepted:
11.12.2022
Online publication date:
15.03.2023

Corresponding Author:
Adem Doğan, M.D., Gaziantep Sehitkamil State Hospital, Clinic of Neurosurgery, Gaziantep, Türkiye
drademdogan@yahoo.com

ORCID:
orcid.org/0000-0003-0933-607

Keywords: Intracranial dermoid and epidermoid tumors, endoscopic approach, minimally invasive surgery

ABSTRACT

Aims: Intracranial dermoid and epidermoid tumors (IDETs), benign, congenital lesions, are traditionally treated using open surgery. However, total resection (TR) can be difficult due to adhesions to surrounding structures. While endoscopic surgery has emerged as a less invasive approach, its success may differ across centers. This study evaluated the outcomes of IDET endoscopic surgery cases and compared them with the literature.

Methods: We retrospectively reviewed patients who underwent an operation for epidermoid and dermoid tumors using an endoscopic approach from 2010 to 2020. Age, sex, tumor location, tumor size, surgical approach, resection rates, intraoperative and postoperative complications, length of hospital stay and recurrence rates of the cases were evaluated.

Results: The study included 18 patients (mean±standard deviation age: 39.6±15.5 years, age range 15-68 years, male sex: n=12, 66.6%). The tumor locations were 2 temporal (11.1%), 2 frontal (11.1%), and 1 occipital (5.5%) (all intraparenchymal); 2 frontobasal (11.1%), 3 suprasellar (16.6%), 2 lateral orbital (11.1%), 1 intraorbital (5.5%), 3 cerebellopontine angle (16.6%), and 1 located in the lateral ventricle (5.5%); and 1 located in the third ventricle (5.5%). TR, near-TR and subtotal resection were performed in 7 (38.8%), 5 (27.7%), and 6 (33.3%) cases, respectively. No postoperative complication was recorded except for one patient who develpped rhinorrhea and pneumocephaly. No intraoperative complication was recorded. The mean length of hospital stay was 7.9 days (range, 5-28 days).

Conclusions: IDETs can be treated by endoscopic approaches, without the need for large incisions and craniotomy in open approaches. Decreased hospital stay seems to be the primary advantage of endoscopic surgery.

Introduction

Intracranial dermoid and epidermoid tumors (IDETs) are benign congenital lesions that constitute approximately 1% of all intracranial lesions (1). In the third to fifth stages of embryogenesis, they occur because of embryological sequestration of the neural tube during ectoderm development (2,3). These lesions can be found at many intracranial locations, often in the cerebellopontine angle (CPA) (4,5). They can rarely be located in the spinal canal.

IDETs are generally treated with standard craniotomy using microscopic methods (6). The traditional open approach requires a large craniotomy and a wide corticotomy. However, total resection (TR) is not possible in most cases due to tumor enlargement toward the subarachnoid area and capsular invasion of the lesions extending into the neural and vascular structures (2,6,7). Therefore, morbidity and mortality rates may be high in patients for whom TR is aimed (6,7). A large craniotomy, wide corticotomy, and significant brain retraction increase the possibility of intraoperative and postoperative complications. Hence, the need for more minimally invasive surgical methods has emerged.

Recently, endoscopic methods have also been used for the treatment of IDET. Some authors have argued that endoscopic interventions have some advantages over microscopic surgeries because they are minimally invasive (8-11).

In this study, we aimed to compare IDET cases treated with endoscopic methods with similar studies in the literature and contribute to the literature in terms of treatment effectiveness.

Methods

Patients

Between 2010 and 2020, patients who underwent an operation for IDET with endoscopic interventions were retrospectively reviewed. Cases operated in our clinic due to dermoid or epidermoid tumors were included in the study. Patients who did not undergo surgery were excluded from the study. Resection rates, difficulties encountered with the endoscopic technique in the intraoperative period, intraoperative and postoperative complications, length of hospital stay, and recurrence rate were evaluated. The Gülhane Training and Research Hospital Local Ethics Committee approved the study protocol (date: 05.12.2020, no: 322).

Radiological evaluation

All patients underwent preoperative magnetic resonance imaging (MRI) that included diffusion sequence because IDETs are distinguished from other cystic lesions because of diffusion restrictions. Computed tomography (CT) and CT angiography orders that were performed to evaluate the relationship between vascular structures and suprasellar and CPA localized tumors were also reviewed. Before the operation, a navigation MRI was also performed.

The tumor resection rate was evaluated according to the intraoperative findings and MRI obtained in the postoperative 3rd month. Tumor resection was classified as TR (TR; complete evacuation of the capsule contents and total excision of the capsule), near-TR (NTR; complete evacuation of the capsule content but the presence of capsule remnant, and subtotal resection (STR) (STR: presence of the remnant of the intracapsular content and capsule).

Age, sex, tumor location and size, surgical approach, resection rates, postoperative complications, histopathological diagnosis, and follow-up periods of the cases were recorded (Table 1).

Surgery

After the induction of general anesthesia, a skull clump was attached and positioned according to the lesion site and surgical procedure. In brief, following positioning, an intraoperative navigation system (Stealth Station, Medtronic, USA, for all patients in this study) is used during surgery. An 11 mm diameter, 5 cm long thoracoport (Tyco Healthcare Group LP, for all patients in this study) is used as the endoscopic port in the endoscopic tubular transcortical (ETTC) approach. Rigid endoscopes (Karl Storz, GmbH & Co. KG, Tuttlingen, Germany, for all patients in this study) with 0°, 30°, and 70° angles, 4 mm diameter, and 18 cm length are used.

The endoscopic endonasal (EE) approach is chosen for midline frontobasal and suprasellar tumors, ETTC approach is chosen for intraparenchymal (frontal, temporal, occipital), lateral orbital, intraorbital and ventricular tumors (lateral and third ventricle), and endoscopic non-tubular posterior fossa (ENTPF) approach is chosen for CPA tumors. In the EE approach, the right lower quadrant of the abdomen or lateral left thigh is used as the source of grafts for the perinasal region and fascia.

A nasoseptal (Hadad) flap is prepared for reconstruction from the appropriate side (12). The sphenoid sinus ostia are identified, and the base of the sellae, tuberculum sella, and part of the planum sphenoidale is opened to reach the dura (Figure 1G-L). For frontobasal localization, the ethmoid bulla is reached after uncinectomy. Anterior and posterior ethmoidectomies are performed, and the anterior and posterior ethmoid arteries are coagulated and cut. After the superior and posterior parts of the nasal septum were resected, the cribriform plate and fovea ethmoidalis are resected, and the dura is exposed (Figure 2G-H). The dura is opened, and the tumor contents are evacuated via endoscopic vision.

In the ETTC approach, depending on the localization of the lesion, a skin incision of approximately 4 cm or a small "horseshoe" flap that would allow a craniotomy of approximately 3x3 cm is made. The dura opens in an "X" shape. After a 1 cm corticotomy, a thoracoport is placed with navigation-guided parenchymal dissection. The lesion was reached by advancing through the port and the tumor contents were evacuated under endoscopic vision (Figure 3G-L, Figure 4G-I). For tumors in the third ventricle, the tumor is visualized from the lateral ventricle with an endoscope using the transforaminal approach. The tumor contents were evacuated via endoscopic vision.

ENTPF approaches (CPA localized cases), after the linear incision, a retrosigmoid suboccipital small craniectomy is performed. The dura is opened in an "X" shape. The cerebellomedullary cistern is opened, some cerebrospinal fluid (CSF) is drained, and cerebellar retraction is achieved. The tumor capsule is accessed, and the tumor contents are evacuated via endoscopic vision.

The tumor was excised using biopsy forceps, curetted, and aspirated. After the contents are completely removed by blunt dissection and copious washing, if the tumor capsule allows resection, it is dissected from the surrounding structures and removed. In cases of aseptic meningitis, the tumor site is washed abundantly with physiological saline. After controlling the bleeding, the closing phase is started.

In the EE approaches, an “inlay” graft is placed in the subdural space of the autologous fascia lata as the first layer for reconstruction after resection. The second layer, fascia lata, or synthetic dura “onlay” graft is laid on the bone defect. As the third layer, a previously prepared nasoseptal flap is placed on the onlay graft. Lumbar drainage is applied to all cases before extubation and 8-10 cc drainage per hour was planned. Following the initiation of oral intake, acetazolamide treatment (3x250 mg/day) is started.

The bone flap is fixed to the cranium after suturing the dura mater except for the EE approach. The skin and subcutaneous tissue are sutured. In the first 24 h after the surgery, CT imaging is performed to rule out possible complications (hematoma and pneumocephaly).

Statistical Analysis

Parameters such as age, gender, symptoms at admission, comorbidities and other quantitative parameters were analyzed. Numerical variables of patient data were expressed as mean±standard error and minimum (lowest)-maximum (highest values). Categorized variables were explained as the number of patients (n) and percentage (%) with descriptive statistics.

Results

Patient population

The study included 18 patients (mean±standard deviation age: 39.6±15.5 years, age range 15-68 years, male sex: n=12, 66.6%). The distribution of the cases according to the location was as follows: 2 temporal (11.1%), 2 frontal (11.1%), 1 occipital (5.5%) (all intraparenchymal); 2 (11.1%) midline frontobasal, 3 (16.6%) suprasellar, 2 (11.1%) lateral orbital, 1 intraorbital (5.5%), 3 (16.6%) CPA, 1 (5.5%) lateral ventricle and 1 (5.5%) third ventricle.

Surgical approach

EE approach (2 midline frontobasal, 3 suprasellar positions) was performed in 5 cases [2 (40%) TR, 1 (20%) NTR, and 2 (40%) STR]. Rhinorrhea and pneumocephalus developed in a patient with a dermoid tumor, despite lumbar drainage. The defect was repaired using the EE method on the sixth postoperative day. As the pneumocephaly continued and the general condition of the patient deteriorated, reconstruction was performed using a pericranial flap with the bifrontal craniotomy approach. The patient was discharged on the 28th day of hospitalization.

The ETTC approach (5 parenchymal, 1 intraorbital, 2 lateral orbital, 2 ventricular positions) was performed in 10 cases [5 (50%)

Table 1. Age, sex, tumor location and size, surgical approach, resection rates, postoperative complications, pathological diagnosis and follow-up periods of the cases

Case	Age/sex	Location	Tumor size (cm)	Approach	Resection	Complication	Pathology	Follow-up (month)
1	27/M	Midline frontobasal	6x3.5x4.8	EE	TR	Rhinorrhea, pneumocephaly	D	60
2	36/M	Suprasellar	3.1x3x3.7	EE	STR	-	E	8
3	55/M	Temporal	2.8x1.7x3	ETTC	TR	-	E	16
4	30/F	Intraorbital	3x1.2x1.8	ETTC	STR	-	E	60
5	44/M	Lateral orbital	2.9x1.7x2	ETTC	TR	-	D	9
6	25/M	Frontal	3.5x2.5x3	ETTC	TR	-	E	60
7	64/M	Lateral orbital	2x2.3x2.5	ETTC	NTR	-	E	20
8	21/M	Cerebellopontine angle	4.5x2.4x4.3	ENTPF	STR	-	E	60
9	33/F	Lateral ventricle	3.5x2.5x2	ETTC	NTR	-	D	48
10	31/M	Suprasellar	3.5x2.5x3	EE	STR	-	D	31
11	22/M	Frontal	4.5x4.5x4	ETTC	NTR	-	E	23
12	68/M	Third ventricle	2.8x2.5x2.6	ETTC	NTR	-	D	11
13	57/M	Occipital	3.5x3x2	ETTC	TR	-	E	60
14	43/M	Temporal	4x3.5x4	ETTC	TR	-	E	60
15	29/F	Midline frontobasal	4x4x3.5	EE	NTR	-	D	48
16	36/F	Cerebellopontine angle	4x4.5x3.5	ENTPF	STR	-	D	40
17	15/F	Cerebellopontine angle	2.5x1.8x2	ENTPF	STR	-	E	7
18	29/F	Suprasellar	2x2.5x3	EE	TR	-	E	50

EE: Endoscopic endonasal, ETTC: Endoscopic tubular transcortical, ENTPF: Endoscopic non-tubular posterior fossa, TR: Total resection (complete excision of tumor contents and capsule), NTR: Near total resection (complete resection of the tumor content and leaving the capsule remnants in places), STR: Subtotal resection (remaining of the capsule and less than 10% tumor content), E: Epidermoid, D: Dermoid, M: Male, F: Female

TR, 4 (40%) NTR, and 1 (10%) STR]. None of the patients developed intraoperative or postoperative complications due to the operation.

The ENTPF approach was applied in 3 cases (localized in the CPA). STR was performed in all of them. No patient developed intraoperative or postoperative complications due to the operation.

No patient-developed complications, such as stroke, septic, and aseptic meningitis, cranial nerve or other neurological injuries, or wound complications.

Seven (38.8%) TR, 5 (27.7%) NTR, and 6 (33.3%) STR were performed (Figures 1-4). In 6 patients who underwent STR, the capsule and a portion of the tumor were left because the tumor capsule adhered to critical neurovascular structures.

In the histopathological evaluation, 11 (61.1%) cases were epidermoid tumors and 7 (38.8%) were dermoid tumors.

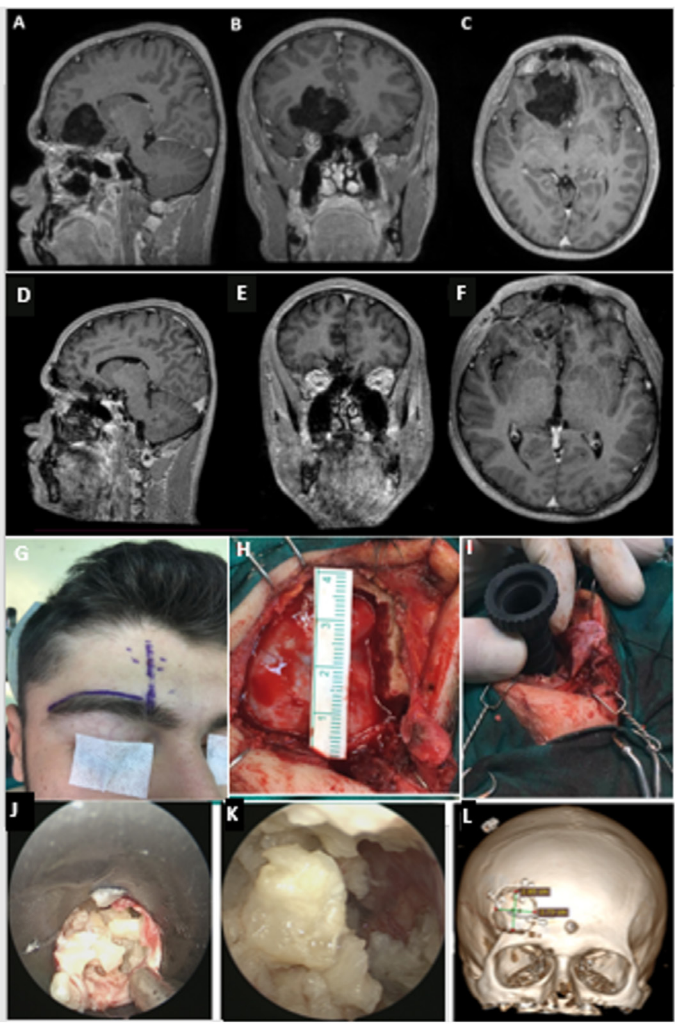

Figure 1. Case #11 Pre-intra-postoperative images of a frontal located epidermoid tumor case operated with ETTC approach. **A-C)** Preoperative cranial T1 contrast MRI. **D-F)** Postoperative 3rd month T1 contrast MRI. **G)** Incision plan and supraorbital nerve line. **H)** After craniotomy. **I)** Placement of the port after corticotomy. **J)** Reaching the tumor tissue. **K)** View of the intraparenchymal area during resection of the tumor. **L)** Three-dimensional view after surgery and craniotomy borders

MRI: Magnetic resonance imaging, ETTC: Endoscopic tubular transcortical

Postoperative period

Lumbar drainage was followed for an average of 5 days (range, 3-8 days). When all the cases were evaluated, the mean length of hospital stay was 7.9 days (range: 5 to 28 days). The reason for a longer hospital stay was the reoperation of a patient with a frontobasal tumor due to rhinorrhea and pneumocephalus. The patients were followed up at the 3rd, 6th, and 12th months in the first year. The mean follow-up period was 37.1 months (range: 7 to 60 months). Reoperation was not required in any patient.

Discussion

IDETs are slow-growing, benign, congenital lesions (4,5). They are usually found in the CPA, the fourth ventricle, and parasellar regions, and are less frequently found in the cerebral hemispheres and brainstem (4,5,13).

The classical surgical treatment of these tumors involves evacuation of the tumor contents under microscopic visualization and then excision of the tumor capsule if the parenchyma tissue allows capsule excision (6). TR of IDET cannot often be possible (14-16). New surgical techniques have been sought to reduce operative morbidity and achieve better surgical results.

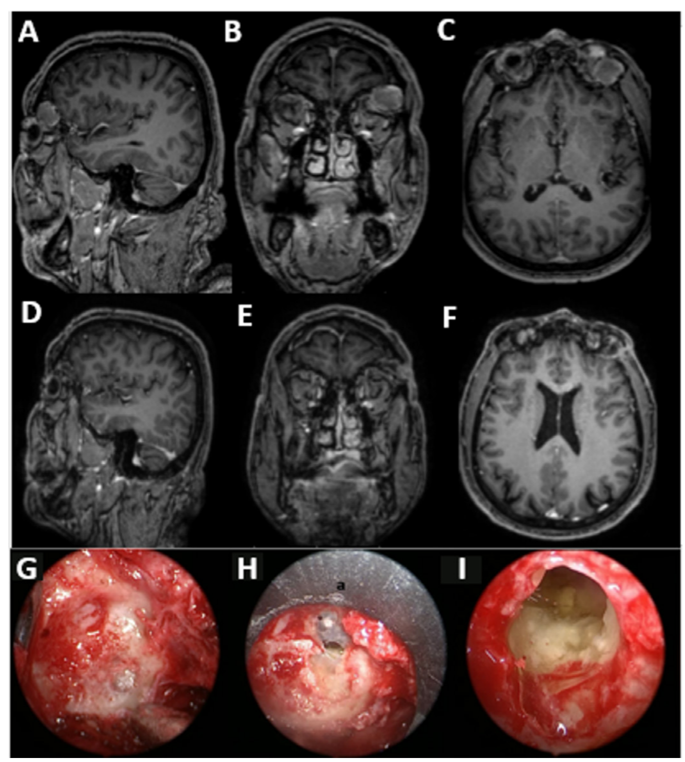

Figure 2. Case #7 Pre-intra-postoperative images of a lateral orbital epidermoid tumor case operated with ETTC approach. **A-C)** Preoperative cranial T1 contrast MRI. **D-F)** Postoperative 3rd-month cranial T1 contrast MRI. **G)** Before craniotomy. **H)** Appearance of tumor after craniotomy (a. port inserted through craniotomy defect). **I)** Stage of tumor resection

MRI: Magnetic resonance imaging, ETTC: Endoscopic tubular transcortical

Endoscopic methods have been used for treating IDET recently owing to their advantages such as panoramic vision, close view, clear detail, and ideal illumination of the surgical area. Additionally, resection of epidermoid and dermoid tumors can be achieved by making less brain retraction, minor craniotomy, and dural incision (17-19). With angled endoscopes (30-45-70 degrees), tumor tissues hidden behind important neurovascular structures under the microscope can be resected without any retraction (13,18,20). As a result, fewer complications occur after surgery. Postoperative complications developed in only 1 of 18 patients who underwent surgery in our study.

Tubular retractors have been used in various cranial approaches, such as intracranial hematomas, cranial tumors, colloid cysts, arteriovenous malformations, and cavernous malformations (9,21). Tubular retractors provide the ability to visualize the tumor and surrounding structures during the operation, as well as to create and maintain a safe corridor into the tumor. The use of a thoracoport also prevents accidental enlargement of the small corticotomy and iatrogenic damage to the surrounding tissues (9,21). Tubular retractors minimized retractor-related force injuries through the radial force distribution. Additionally, with tubular retractor systems, deep white matter tracts can be divided and preserved instead of being cut using the blunt tip and progressive dilation technique (9,21). Thoracoport has been especially used in endoscopic surgery of deeply located tumors because it allows dynamic mobilization and facilitates bimanual operation (9,21). In transcortical approaches since non-tubular retractors do not apply equal force to the surrounding parenchyma, the stress on the brain tissue may cause increased local cerebral tissue pressure and impaired regional cerebral blood flow. It has even been reported that this may cause focal neurological deficits, seizures, or cognitive disorders (9,21). Additionally, non-tubular retractors may cause damage to the surrounding parenchyma by applying high pressure during withdrawal. We also used a thoracoport in our cases with intraventricular, intraparenchymal, and intra-lateral orbital localizations and did not need a large craniotomy.

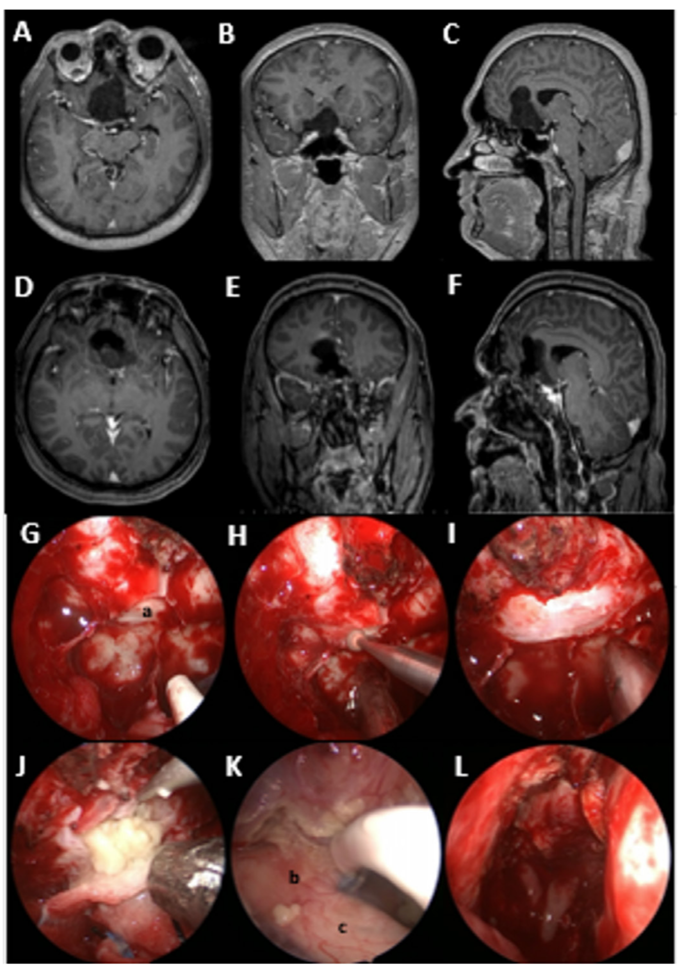

Figure 3. Case #2 Pre-postoperative images of a suprasellar epidermoid tumor case operated by the EE approach. **A-C)** Preoperative cranial T1 contrast MRI, **D-F)** Postoperative day 0 cranial T1 contrast MRI. **G)** Sphenoid sinus (a. Floor of the sella). **H)** Drilling of the floor of the sella. **I)** Before opening the dura. **J)** Evacuation of tumor contents. **K)** Tumor lodge after resection (b. Optic chiasm, c. Left optic nerve), **L.** Resection post-reconstruction phase and laying of the nasoseptal flap

MRI: Magnetic resonance imaging, EE: Endoscopic endonasal

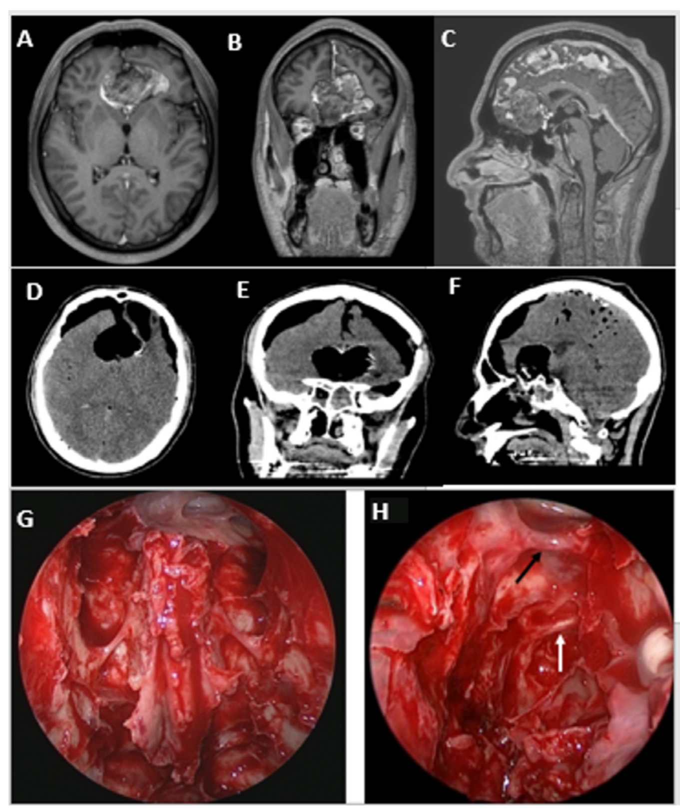

Figure 4. Case #1 A midline frontobasal dermoid tumor case operated by the EE approach. **A-C)** Preoperative cranial T1 contrast MRI, **D-F)** Postoperative cranial tomography. **G)** Identification of the cribriform plate. **H)** View of the anterior (black arrow) and posterior ethmoidal (white arrow) arteries

MRI: Magnetic resonance imaging, EE: Endoscopic endonasal

Generally, resection rates range from 0% to 97% in IDETs surgically treated using the microscopic method (14,15,19,20,22). Yaşargil et al. (6) reported a TR rate of 95% in the epidermoid tumor series that they treated with the microscopic operation. Velho et al. (22) reported a rate of 15.3% in their series containing 234 IDET cases that they treated with microscopic methods. Singh et al. (23) reported a TR rate of 91.6% and an STR rate of 8.3% in their series of 48 cases, which they treated with combined endoscopic and microscopic techniques. In that study, the cases were first treated with a microscopic technique, and then the surgical area was controlled with an endoscope. Residual tumor was detected in 38 patients (79%) after endoscopic control, therefore, the authors stated that the endoscopic method is more beneficial. Similarly, other studies have shown that endoscopic procedures are at least as effective as microscopic procedures in removing these tumors (18,24,25). In our study, resection results were also correlated with endoscopic studies in the literature: 7 (38.8%) total, 5 (27.7%) NTR, and 6 (33.3%) STRs were performed.

When IDET cases located in the CPA were evaluated, Gopakumar et al. (26) reported TR in a bilateral epidermoid tumor using endoscopic methods. Additionally, Peng et al. (18) reported 83% TR in six cases localized in the pontocerebellar angle and treated with endoscopic interventions. In our study, capsular resection could not be performed in all three cases of tumors localized in the CPA because of the adhesion of the tumor capsule to critical neurovascular structures, and the tumor resection remained at the subtotal level. In our study, capsular resection could not be performed in all three cases of tumors located in the CPA due to the adhesion of the tumor capsule to critical neurovascular structures, and the tumor resection remained at a subtotal level. Insisting on resection in these cases may cause cranial nerve damage or vascular injury.

When the resection of intraventricular IDET is examined, Paz et al. (24) reported STR of an epidermoid tumor localized in the third ventricle with suprasellar extension who underwent endoscopic resection. In our study, NTR was achieved in both cases located in the lateral and third ventricles. Because of its proximity to critical neurovascular structures, lesions of this region are difficult to remove to a large extent. However, tumor tissues were largely resected in 2 of our cases.

Recently, EE approaches have also been used in the treatment of non-pituitary lesions of the midline ventral skull base (25,27-29). These approaches provide a direct surgical route to tumor access by minimizing neurovascular manipulation and eliminating brain retraction, without the need for a skin incision (27,28,30). In a study including 21 cases (suprasellar, prepontine, parasellar, anterior-middle cranial fossa localized) with epidermoid and dermoid tumors treated with the EE approach, 8 (38.1%) patients had a total, 9 (42.9%) patients had gross total, and 4 (42.9%) patients had reported STR (30). When the literature was reviewed, other studies reporting successful resection rates for the EE resection of dermoid and epidermoid tumors localized in the suprasellar region, and anterior and middle cranial fossa were also found (18,25,31). In our study, TR was performed in 2 of the 5 cases with midline frontobasal and suprasellar localization, with the EE route, and NTR in 1 and STR in 2 patients.

Another advantage of endoscopic surgery is its short hospital stay. It has been reported that 86% of the patients in the TR group were followed in the intensive care unit for more than 10 days in 234 intracranial epidermoid tumor cases operated with microscopic methods (22). Also, the hospitalization period in an epidermoid tumor case operated with microscopic methods was reported 7 days (32). The length of hospital stay after EE resection of IDET ranges from 3 to 5 days in many studies (17,33,34). In one of our cases with a frontobasal location, the hospitalization duration was prolonged because of postoperative rhinorrhea and pneumocephalus, and the patient was discharged on the 28th day of hospitalization. Therefore, the mean length of hospital stay in our series was prolonged to 7.9 days (range, 5-28 days).

Another problem in the surgery of IDET is postoperative recurrence. Generally, the recurrence rates after the resection of IDET range from 1% to 27% (6,22,35,36). Singh et al. (23) did not report recurrence in 48 intracranial epidermoid tumors using the combined endoscopic and microscopic technique. Vaz-Guimaraes et al. (30) reported recurrence in two cases (9.5%) who underwent inadequate resection due to the suprasellar extension among 21 patients (15 primary, 6 relapses). Reoperation of these tumors is difficult due to their adhesion to the surrounding critical neurovascular structures after the first surgery (6,37). Therefore, these tumors should be reoperated when the patient becomes symptomatic again. Reoperation is usually done for decompression purposes. It is not easy to predict the time of recurrence. Although dermoid tumors are easier to resect than epidermoid tumors because of their dark consistency, these tumors may recur more aggressively than epidermoid tumors (6,20,37). The rate of postoperative morbidity in reoperated patients is higher than in patients who undergo primary surgery (6,7). The mean follow-up period in our cases was 37.1 months (range, 7 to 60 months). During the follow-up period, none of the patients who underwent near total and STRs required reoperation.

The mortality rate was reported as 5% in 43 patients with IDET who were operated with the microscopic methods (37). It has been reported in the literature that a patient with a tumor located in the parasellar region, who was operated with microscopic methods, died from hydrocephalus and other complications in the postoperative period (38). No mortality was encountered in the postoperative period in any of our cases. Although it was located at critical locations, mortality did not develop in any of our cases during the postoperative period.

Endoscopic methods have both advantages and disadvantages. First, the images obtained with the endoscope are two-dimensional. Another disadvantage of the endoscope is the long learning curve of the endoscopic surgical technique. That is, the skill of using the endoscope is a time-consuming process.

Complications such as aseptic meningitis, bacterial meningitis, anosmia, hypopituitarism, and cranial nerve paralysis have been reported in addition to rhinorrhoea in EE approaches (30). In the epidermoid and dermoid tumor series of 21 cases (15 primary and 6 relapses) treated with the EE route, CSF leakage was reported in 5 cases, bacterial infection was reported in 4 cases, transient 6th cranial nerve palsy was reported in 2 cases, and hydrocephalus requiring ventriculoperitoneal shunt was reported in 4 cases (30). In our study, postoperative complications, which were rhinorrhea and pneumocephalus, occurred in only 1 of 5 patients (midline frontobasal tumor) who underwent EE surgery. Complications such as aseptic meningitis, bacterial meningitis, focal neurological deficit, cranial nerve paralysis, seizures, hearing loss (especially in cases with CPA localization), wound infection, deep vein thrombosis and pulmonary embolism, and hydrocephalus requiring postoperative shunt have been reported in non-endonasal approaches (6,14,15,22,30). In our study, the capsule contents and subarachnoid spaces were washed with plenty of saline during the operation, and aseptic meningitis did not develop in any patient.

Study Limitations

The strength of our study is limited by its retrospective data collection and small sample size. Additionally, there are no long-term follow-up data available.

Conclusion

To the best of our knowledge, this is the first study from Türkiye to report the outcomes after endoscopic resection of IDETs. The success with endoscopic resection of epidermoid and dermoid tumors in various parts of the intracranial region, including the ventral skull base, appears similar to open resection using microscopic methods.

Ethics

Ethics Committee Approval: The Gülhane Training and Research Hospital Local Ethics Committee approved the study protocol (date: 05.12.2020, no: 322).

Informed Consent: This was a retrospective study, and descriptive data (identity information, face picture) were not used. Therefore, patient consent was not obtained for this study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: A.D., M.O.D., Concept: A.D., A.M.K., Design: A.D., A.M.K., S.K., Data Collection or Processing: A.D., Ş.K., Analysis or Interpretation: M.O.D., A.M.K., Ş.K., Literature Search: A.D., M.O.D., Writing: A.D., M.İ.Ö.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Bonde V, Goel A. Interdural cavernous sinus epidermoid cyst. J Clin Neurosci. 2008;15:212-214.
2. Ho L, Olivi A, Cho CH, Burger PC, Simeone F, Tihan T. Well-differentiated Papillary Adenocarcinoma Arising in a Supratentorial Enterogenous Cyst: Case Report. Neurosurgery. 1998;43:1474-1477.
3. Schneider UC, Koch A, Stenzel W, Thomale UW. Intracranial, supratentorial dermoid cysts in paediatric patients--two cases and a review of the literature. Childs Nerv Syst. 2012;28:185-190.
4. Orakcioglu B, Halatsch ME, Fortunati M, Unterberg A, Yonekawa Y. Intracranial dermoid cysts: variations of radiological and clinical features. Acta Neurochir (Wien). 2008;150:1227-1234.
5. Osborn AG, Preece MT. Intracranial Cysts: Radiologic-Pathologic Correlation and Imaging Approach. Radiology. 2006;239:650-664.
6. Yaşargil MG, Abernathey CD, Sarioglu A. Microneurosurgical Treatment of Intracranial Dermoid and Epidermoid Tumors. Neurosurgery. 1989;24:561-567.
7. Ullah A, Khan M, Ali M. Microsurgical Resection of Intracranial Dermoid and Epidermoid Tumors. Pak J of Neurol Surg. 2020;24:21-27.
8. Forbes JA, Banu M, Lehner K, et al. Endoscopic endonasal resection of epidermoid cysts involving the ventral cranial base. J Neurosurg. 2018:1-10.
9. Kutlay M, Kural C, Solmaz I, et al. Fully Endoscopic Resection of Intra-Axial Brain Lesions Using Neuronavigated Pediatric Anoscope. Turk Neurosurg. 2016;26:491-499.
10. Lynch JC, Aversa A, Pereira C, Nogueira J, Gonçalves M, Lopes H. Surgical strategy for intracranial dermoid and epidermoid tumors: An experience with 33 Patients. Surg Neurol Int. 2014;5:163-172.
11. Majmudar V, Loffeld A, Happle R, Salim A. Phacomatosis pigmentokeratotica associated with a suprasellar dermoid cyst and leg hypertrophy. Clin Exp Dermatol 2007;32:690-692.
12. Hadad G, Bassagasteguy L, Carrau RL, et al. A Novel Reconstructive Technique After Endoscopic Expanded Endonasal Approaches: Vascular Pedicle Nasoseptal Flap. Laryngoscope. 2006;116:1882-1886.
13. Figueiredo EG, Beer-Furlan A, Nakaji P, et al. The Role of Endoscopic Assistance in Ambient Cistern Surgery: Analysis of Four Surgical Approaches. World Neurosurg. 2015;84:1907-1915.

14. Chowdhury FH, Haque MR, Sarker MH. Intracranial epidermoid tumor; microneurosurgical management: An experience of 23 cases. Asian J Neurosurg. 2013;8:21-28.

15. Chowdhury FH, Haque MR. Endoscopic assisted microsurgical removal of cerebello-pontine angle and prepontine epidermoid. J Neurosci Rural Pract. 2012;3:414-419.

16. Lewis AJ, Cooper PW, Kassel EE, Schwartz ML. Squamous cell carcinoma arising in a suprasellar epidermoid cyst. J Neurosurg. 1983;59:538-541.

17. Grayson JW, Chaaban MR, Riley KO, Woodworth BA. Smell Sparing Unilateral Intracranial Dermoid Resection. Allergy Rhinol (Providence). 2014;5:39-40.

18. Peng Y, Yu L, Li Y, Fan J, Qiu M, Qi S. Pure endoscopic removal of epidermoid tumors of the cerebellopontine angle. Childs Nerv Syst. 2014;30:1261-1267.

19. Tuchman A, Platt A, Winer J, Pham M, Giannotta S, Zada G. Endoscopic-Assisted Resection of Intracranial Epidermoid Tumors. World Neurosurg. 2014;82:450-454.

20. Ebner F, Roser F, Thaher F, Schittenhelm J, Tatagiba M. Balancing the Shortcomings of Microscope and Endoscope: Endoscope-Assisted Technique in Microsurgical Removal of Recurrent Epidermoid Cysts in the Posterior Fossa. Minim Invasive Neurosurg. 2010;53:218-222.

21. Kutlay M, Durmaz O, Ozer İ, et al. Fluorescein Sodium-Guided Neuroendoscopic Resection of Deep-Seated Malignant Brain Tumors: Preliminary Results of 18 Patients. Oper Neurosurg (Hagerstown). 2021;20:206-218.

22. Velho V, Bhide A, Naik H, Jain N. Surgical Management of Intracranial Epidermoid Tumors-An Institutional Review of 234 Cases. Indian Journal of Neurosurgery. 2019;8:25-33.

23. Singh I, Rohilla S, Kumar P, Krishana G. Combined microsurgical and endoscopic technique for removal of extensive intracranial epidermoids. Surg Neurol Int. 2018;9: 36-43.

24. Paz DA, da Costa MDS, Rodrigues TP, Riechelmann GS, Suriano ÍC, Zymberg ST. Endoscopic Treatment of a Third Ventricular Epidermoid Cyst. World Neurosurg. 2017;99:813-819.

25. Prevedello DM, Fernandez-Miranda JC, Gardner P, et al. The transclival endoscopic endonasal approach (EEA) for prepontine neuroenteric cysts: report of two cases. Acta Neurochir (Wien). 2010;152:1223-1229.

26. Gopakumar S, Srinivasan VM, Sharma H, Cherian J, Patel AJ. Fully Endoscopic Resection of an Epidermoid Cyst of the Cerebellopontine Angle: Bilateral Resection via a Unilateral Approach. Oper Neurosurg (Hagerstowns). 2021;20:152-155.

27. Castelnuovo P, Dallan I, Battaglia P, Bignami M. Endoscopic endonasal skull base surgery: past, present and future. Eur Archf Otorhinolaryngol. 2010;267:649-663.

28. Fraser JF, Nyquist GG, Moore N, Anand VK, Schwartz TH. Endoscopic endonasal transclival resection of chordomas: operative technique, clinical outcome, and review of the literature. J Neurosurg. 2010;112:1061-1069.

29. Özer Mİ, Kutlay AM, Durmaz MO, et al. Extended endonasal endoscopic approach for anterior midline skull base lesions. Clin Neurol Neurosurg. 2020;196:106024.

30. Vaz-Guimaraes F, Koutourousiou M, de Almeida JR, et al. Endoscopic endonasal surgery for epidermoid and dermoid cysts: a 10-year experience. J Neurosurg. 2018:1-11.

31. McCoul ED, Chow S, Lee DL, Anand VK, Schwartz TH. Endoscopic endonasal approach for resection of ventral skull base keratinaceous cysts. Int Forum Allergy Rhinol. 2012;2:258-263.

32. Onoda K, Kawaguchı A, Takaya Y, et al. A Case Of Dermoid Cyst Arising İn The Temporal Lobe. NMC Case Rep J. 2021;8:529-534.

33. Düz B, Secer H, Tosun F, Gonul E. Endoscopic Endonasal Resection of a Midline Intradural Frontobasal Dermoid Tumour. Minim Invasive Neurosurg. 2007;50:363-366.

34. Kuran G, Yazici D. Endoscopic Transnasal Transpterygoid Excision of an Infratemporal Dermoid Cyst. J Craniofac Surg. 2017;28:951-954.

35. Lynch JC, Welling LC, Aversa A, et al. Surgical Strategy for Dermoid and Epidermoid Tumors of the Posterior Fossa - Experience with 21 Patients. Arquivos Brasileiros de Neurocirurgia: Brazilian Neurosurgery. 2017;36:145-152.

36. Schiefer TK, Link MJ. Epidermoids of the cerebellopontine angle: a 20-year experience. Surg Neurol. 2008;70:584-590.

37. Zada G, Liu C, Apuzzo ML. “Through the Looking Glass”: Optical Physics, Issues, and the Evolution of Neuroendoscopy. World Neurosurg. 2012;77:92-102.

38. Bobeff EJ, Sánchez-Viguera C, Arráez-Manrique C, Arráez-Sánchez MÁ. Suprasellar Epidermoid Cyst: Case Report of Extended Endoscopic Transsphenoidal Resection and Systematic Review of the Literature. World Neurosurgery. 2019;128:514-526.