INTRODUCTION

Epidermoid cysts are benign, congenital lesions that originate from ectodermal cells and are most commonly found in the cerebellopontine angle, but rarely in the ventricular system. Symptoms associated with these lesions include headaches, nausea, vomiting, and visual disturbances caused by increased intracranial pressure due to obstructive hydrocephalus. When symptomatic, the definitive treatment for epidermoid cysts is surgical resection. While many different microsurgical techniques have been described for resecting these lesions, neuroendoscopic approaches have not been as thoroughly evaluated. Here, we report a case of a 63-year-old female presenting with confusion and somnolence attributed to a recurrent epidermoid cyst of the third ventricle and its effective treatment utilizing an endoscopic technique, while also reviewing the appropriate literature.
Clinical presentation
A 63-year-old female presented with several days of confusion/ altered level of consciousness. She had a Glasgow Coma Score of 14, was lethargic, and demonstrated a left homonymous hemianopsia. In 2015, she had undergone a craniotomy for subtotal resection of an epidermoid cyst. Now, the computed tomography (CT) scan revealed a large mixed-density suprasellar mass effacing the third ventricle, with a notable increase in the size of the cyst [Figure 1].

Surgical management
Through a small, elliptical right frontal craniotomy and corticectomy, the third ventricle was entered using an 11.5 mm Thoracoport with the assistance of stereotactic navigation. An endoscope was placed down the port and through the foramen of Monroe; tumor was identified as adherent to the floor of the third ventricle. An Angiocath, attached to a syringe, was utilized to drain the cyst. Pulsatile bacitracin/normal saline irrigation was then utilized to flush the ventricular system, and the cyst contents were gently suctioned and removed. Liliequist’s membrane was identified, and additional tumor was noted to be deep to the membrane. When it was opened, keratin fragments were mobilized with pulsatile irrigation. Endoscopic biopsy instruments then afforded removal of more adherent tissue. The remaining fragments that had settled in the occipital horn were also mobilized and removed. A ventricular catheter was then left in place as the Thoracoport was removed. Postoperatively, the patient exhibited a left gaze preference (without a residual field cut) that persisted. Imaging consistent with gross total resection [Figure 2]. Her GCS improved from 14 to 15. The external ventricular drain (EVD) was successfully removed on postoperative day 3, and she was discharged back to the nursing facility on day 6. Four weeks later, she developed a pseudomeningocele over the craniotomy site that was treated with a head wrap for 1 week. Her gaze preference was noted to have resolved on outpatient follow-up. Imaging of 4 month followup demonstrated no signs of recurrence [Figure 3].

DISCUSSION

Review of literature
A review of literature, including our case, yielded 15 cases undergoing resection of the third ventricular epidermoid cysts [Table 1]. Of these, nine lesions were removed microsurgically, while six were approached endoscopically. Patients averaged 40.1 years of age and included eight males and seven females. Hydrocephalus was noted in all but one of the cases. For the one patient without hydrocephalus, the majority of the tumor was within the cavum septum pellucidum (e.g., did not obstruct normal cerebrospinal fluid [CSF] flow). Gross total resection was achieved in 10/15 cases (67%). Transcallosal approaches achieved gross total resection in 3/5 (60%) cases, while endoscopic approaches yielded gross total resection in 5 of 6 cases (83%). Gross total resection was also achieved utilizing the supracerebellar infratentorial and transventricular approaches. The three transbasal, parieto-occipital transcortical, or endoscopic transtemporal approaches all resulted in subtotal resections; >95% of the tumor was removed, as residual tumor was adherent to major neurovascular structures (e.g. vein of Galen and posterior choroidal artery). Similarly, Kumar reported leaving residual tumor due to its adherence to the floor of the third ventricle. Further, Gaab and Schroeder reported a gross total resection with wide margins; however, the cyst recurred despite complete removal.

In all but one case, hydrocephalus resolved. In cases where an EVD was used postoperatively, there were no reported cases of aseptic meningitis.

Anatomy and pathophysiology of epidermoid tumors
Epidermoid cysts are slow-growing, benign lesions that comprise 0.2%–1.8% of all intracranial tumors. A review of 432 cases of intracranial epidermoid cysts revealed that only

Figure 1: Preoperative – *(a) Noncontrast computed tomography head demonstrating epidermoid cysts of the third ventricle. (b) Axial T2 sequence showing the cystic and solid components of the tumor. (c) Diffusion-weighted imaging showing the characteristic diffusion restriction associated with epidermoid cysts. (d) T1 postcontrast axial sequence showing enhancement of the solid component of the cyst with minimal enhancement within the cystic component. (e) T1 postcontrast sagittal sequence showing occupation of the third ventricle by the tumor.
Table 1: Review of literature on epidermoid cysts in the third ventricle.

| Authors                      | Age/Sex | Symptoms                                                  | Location in the third ventricle | Surgical technique       | Gross total resection | Preoperative hydrocephalus | EVD preoperative | EVD/VP shunt postoperative | Complications                                      |
|------------------------------|---------|-----------------------------------------------------------|---------------------------------|--------------------------|-----------------------|---------------------------|-------------------------|-----------------------------------|---------------------------------------------------|
| Smith and Chamoun, 2014       | 51, male| Headaches, confusion, disorientation, memory difficulties | Posterior third                 | Endoscopic transcortical | Yes                    | Yes                       | No                      | EVD×2-day postoperative          | None                                             |
| Santosh et al., 2001          | 23, female| Mastalgia and galactorrhea                                | Posterior extending to the right thalamic region | Parieto-occipital transcortical | No                   | N/A                       | No                      | No                                | Galactorrhea improved, but persisted |
| Paz et al., 2017              | 50, female| Drowsiness, disorientation, apathy                        | Anterior third extending through foramen of Monroe | Endoscopic transcortical | No                    | Yes                       | Yes                     | No                                | None                                             |
| Kontoangelos et al., 2013     | 32, male| Severe headache, fatigue, depressed mood, insomnia, reduced ability to think/concentrate | Posterior with obstruction of cerebral aqueduct | Endoscopic transcortical+ETV | Yes                   | Yes                       | No                      | No                                | None                                             |
| Shimizu et al., 1985          | 15, male| Severe headache, nausea                                   | Complete obstruction extending into preptontine cistern | Interhemispheric transcortical | Yes                   | Yes                       | Yes                     | No                                | Mild diabetes insipidus, subdural effusion |
| Iaconetta et al., 2001        | 25, male| Headache, visual disturbances, bilateral papilloedema      | N/A                             | Supracerebellar infratentorial | Yes                   | N/A                       | No                      | No                                | None                                             |
| Riviere et al., 1996          | 36, male| Headache, memory disturbances                             | Entire third ventricle developing mainly from the left side | Trans-ventricular approach | Yes                   | Yes                       | No                      | VP shunt                          | Aseptic meningitis, transient Korsakoff’s syndrome, hypopituitarism |
| Koumtchev et al., 2002        | 34, male| Headache, double vision, staggering gate, recurrent tumor | Anterior third obstructing both foramen of Monroe | Endoscopic transforaminal | Yes                   | Yes                       | No                      | No                                | None                                             |
| Bikmaz et al., 2007           | 29, male| None (incidental discovery due to head trauma)            | Third ventricle, cavum septum    | Interhemispheric transcortical | Yes                   | No                        | No                      | No                                | None                                             |
| Kumar et al., 2014            | 40, male| Diabetes insipidus, headache, mild bilateral papilledema  | Anterior third                  | Transbasal translamina terminalis | No                   | Yes                       | No                      | No                                | None                                             |
0.7% were located in the third ventricle. Their intracerebral or intraventricular locations result from segregation of epithelium at the 3rd week of embryogenesis, rather than the 5th week. Their bulging, irregular shape is formed by squamous epithelium, while desquamation of the cyst wall produces a liquid interior composed of keratin, water, and cholesterol – giving them a pearly white appearance intraoperatively. Yavşargil et al. described these tumors as “flowing” into any available subarachnoid spaces – defining the extra-axial nature of these lesions. Due to their slow-growing nature, the peak incidence of these tumors is in the fourth decade. Most patients are asymptomatic, with patients reporting vague symptoms such as headache, feeling “foggy,” or blurry vision.

Clinical, radiographic diagnosis, and treatment of the third ventricular epidermoid tumors

These lesions are typically incidental findings on CT, but magnetic resonance imaging is often the optimal confirmatory test. Both display hypointensity on T1 and hyperintensity on T2; however, epidermoid cysts will exhibit diffusion restriction on diffusion-weighted imaging while arachnoid cysts typically do not. Those with hydrocephalus can be effectively treated with ventriculoperitoneal shunts, but this does not resolve the underlying tumor progression. Where surgical resection is

Table 1: Continued

| Authors                  | Age/Sex | Symptoms                          | Location in the third ventricle | Surgical technique                      | Gross total resection | Complications                                      |
|--------------------------|---------|-----------------------------------|---------------------------------|----------------------------------------|-----------------------|---------------------------------------------------|
| Hendricks et al., 2016   | 36, male| Hemiparesis, gait disturbance, recurrent tumor | Complete, extending into lateral ventricles and suprapineal region | Interhemispheric transcallosal        | No                    | None                                             |
| Gelabert-Gonzalez et al., 2002 | N/A, female | Headaches, nausea, vomiting | Complete third ventricle | Interhemispheric transcallosal          | No                    | N/A                                               |
| Giannotta et al., 1976   | 61, female | Headache, mental disturbances | Anterior | Endoscopic transcortical             | Yes                   | No                                                |
| Schroeder, 1989          | 63, female | Left leg hemiparesis, decreased left visual field | Anterior | Endoscopic transcortical             | Yes                   | EVD postoperative                                 |
| Our case                 | 63, female | Lethargy, confusion, decreased left visual field | Anterior | Endoscopic transcortical             | Yes                   | EVD×3-day postoperative                           |

EVD: External ventricular drain, VP: Ventriculoperitoneal
indicated, it is the best to avoid placing a ventriculostomy, due to the risk of aseptic meningitis from entry of epidermoid crystals into the CSF. Optimally, gross total resection and cyst removal should be performed to avoid lesion and cyst recurrence.

Surgical approaches to the third ventricle

There are three essential approaches to the third ventricle: transcortical, transcallosal, and endoscopic. The transcortical approach traditionally utilizes entry to the ventricle through a right frontal trajectory. There are, however, three variations of this approach utilizing a frontal, parietal, or middle temporal gyrus trajectory.[5] The interhemispheric transcallosal approach, first described by Dandy, in 1915, employs an entry through the midline utilizing gravity to aid in brain retraction and to minimize any physical retraction required for exposure.[20] Notably, it provides maximal exposure to the third ventricle. Nevertheless, this route poses an increased risk of damage to the superior sagittal sinus and bridging veins, and the fornix (e.g., causing memory loss). Although Apuzzo and Litofsky reported a seizure rate of 25% with transcrallosal versus just 8% with transcortical operations in their series of 127 Patients.[23] The neuroendoscopic technique was first described in 1983 by Powell et al. and was modernized by Gaab and Schroeder, in 1998.[2,6,7] The standard endoscopic approach to the third ventricle utilizes a right frontal trajectory, decreasing the amount of eloquent tissue that must be passed to reach the third ventricle. The major limitation of this technique includes the limited flexibility in the field of view and the limited number of instruments that can be passed through the endoscope. In the cases reviewed, the endoscopic approach has yielded four cases, including our own, of total resections of the cysts with no postoperative complications. We believe this approach minimizes damage to deep white matter structures and the Thoracon assisted flexible endoscopes, and higher definition endoscopes provide better maneuverability to visualize the surrounding structures.

CONCLUSION

There are various microsurgical and endoscopic techniques for approaching epidermoid cysts/tumors in the third ventricle. The aim is to limit disruption of normal tissue and injury to the limbic system, while still providing adequate surgical exposure. In our case and reviewing the literature, we noted gross total resection of these lesions could be achieved in 83% of endoscopic cases (5/6), compared to 3/5 utilizing the interhemispheric approach. Further, advances in endoscopy may eventually establish this technique as the new standard of care for the surgical management of the third ventricular epidermoid cysts.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Bikmaz K, Dinc C, Cakabiy M, Iplikioglu AC. Epidermoid cyst of the cavum septum pellucidum. Acta Neurochir (Wien) 2007; 149:1271-2.
2. Brandão FR, Black P, Filho H. Approaches to the third ventricle. Braz Arch Neurosurg 2012;31:3-9.
3. Caldarrelli M, Massimi L, Kondageski C, Di Rocco C. Intracranial midline dermoid and epidermoid cysts in children. J Neurosurg 2004; 100:473-80.
4. Chowdhury FH, Haque MR, Sarker MH. Intracranial epidermoid tumor; Microneurosurgical management: An experience of 23 cases. Asian J Neurosurg 2013;8:21-8.
5. D’Angelo VA, Galarza M, Catapano D, Monte V, Bisciglia M, Carosi I. Lateral ventricle tumors: Surgical strategies according to tumor origin and development-a series of 72 cases. Oper Neurosurg 2005;56:36-45.
6. Gaab MR, Schroeder HW. Neuroendoscopic approach to intraventricular lesions. J Neurosurg 1998;88:496-505.
7. Gaab MR, Schroeder HW. Neuroendoscopic approach to intraventricular lesions. Neurosurg Focus 1999;6:e5.
8. Gelabert-González M, García-Allut A, González-García J, Martínez-Rumbo R. Epidermoid tumor of the third ventricle. Neurocirugía 2002; 13:389-92.
9. Giannotta SL, Pauli F, Farhat SM. Epidermoid cyst of the third ventricle. Surg Neurol 1976;5:164-6.
10. Hendricks BK, Cohen-Gadol AA. Resection of large recurrent third ventricular epidermoid tumors through the posterior interhemispheric transcallosal approach. Neurosurg Focus 2016;40 Video Suppl 1:2016.1.FocusVid.15466.
11. Iaconetta G, Samii M. Third ventricle epidermoid cyst. Br J Neurosurg 2001;15:529-30.
12. Kontoangelos K, Economou M, Maltezou M, Kandaraki A, Papadimitriou GN. Depressive symptomatology and pineal epidermoid cyst: A case report. Acta Neuropsychiatr 2013;25:240-2.
13. Koutchnev YN, Kalnev YN, Gozmanov YN, Zaprianov YN. Recurrence of epidermoid cyst in the third ventricle. Case report. Folia Med (Plovdiv) 2002;44:97-9.
14. Kumar A, Singla R, Sharma BS. Anterior third ventricular epidermoid presenting with diabetes insipidus. Neurol India 2014;62:86-8.
15. Man R. A rare case of third ventricular epidermoid cyst as seen by newer MRI sequences. Int Neuropsychiatr Dis J 2014;2:68-77.
16. Meng L, Yuguang L, Shugan Z, Xingang L, Chengyuan W. Intraventricular epidermoids. J Clin Neurosci 2006;13:428-30.
17. Nagasawa D, Yew A, Safaee M, Fong B, Gopen Q, Parsa AT, et al.
Clinical characteristics and diagnostic imaging of epidermoid tumors. J Clin Neurosci 2011;18:1158-62.

18. Osborn AG, Preece MT. Intracranial cysts: Radiologic-pathologic correlation and imaging approach. Radiology 2006;239:650-64.

19. Paz DA, da Costa MD, Rodrigues TP, Riechelmann GS, Suriano IC, Zymberg ST. Endoscopic treatment of a third ventricular epidermoid cyst. World Neurosurg 2017;99:813.e7-11.

20. Perneczky A, Kindel S, Kanno T, Tschabitscher M, Reisch R. Keyhole Approaches in Neurosurgery: Concept and Surgical Technique. Vol. 1. New York: Springer Science and Business Media; 2009.

21. Powell MP, Torrens MJ, Thomson JL, Horgan JG. Isodense colloid cysts of the third ventricle: A diagnostic and therapeutic problem resolved by ventriculoscopy. Neurosurgery 1983;13:234-237.

22. Reddy P, Jiacheng S, Xunning H, Ma Z. Intracranial epidermoid cyst: Characteristics, appearance, diagnosis, treatment and prognosis. Sci Lett 2015;3:102-10.

23. Riviérez M, Ridarch A, Landau-Ossondo M, Randrianbololona J. Epidermoid cyst of the third ventricle. Report of a case. Neurochirurgie 1998;44:283-6.

24. Santosh IP, Rajeshkhar V. Galactorrhea as the sole presenting symptom of a posterior third ventricular epidermoid cyst. Surg Neurol 2001;55:46-9.

25. Schroeder HW, Oertel J, Gaab MR. Endoscope-assisted microsurgical resection of epidermoid tumors of the cerebellopontine angle. J Neurosurg 2004;101:227-32.

26. Shimizu Y, Aihara H, Fukawa O, Ishii M. Epidermoid of the third ventricle--report of a case. No Shinkei Geka 1985;13:71-6.

27. Smith KA, Chamoun R. Endoscopic resection of an intraventricular epidermoid cyst of the third ventricle. Neurosurg Q 2014;24:229-31.

28. Yaşargil MG, Abernathey CD, Sarioglu AC. Microneurosurgical treatment of intracranial dermoid and epidermoid tumors. Neurosurgery 1989;24:561-7.

How to cite this article: Kashyap S, Cheema B, Chhabra V. Endoscopic resection of the third ventricular epidermoid cysts: A case review and review of literature. Surg Neurol Int 2019;10:98.