Chapter 4
Application of Endoscopy to Third Ventricular Tumors

INTRODUCTION

Tumors located in the third ventricle present a challenging management scenario for the neurosurgeon. This is primarily because of the critical neuroanatomic structures situated adjacent to the abnormality. Included among these critical structures are the optic apparatus, hypothalamus, pituitary gland, fornices, and midbrain. As a result, direct attack on third ventricle tumors, whether surgical or radiotherapeutic, can be fraught with severe complications. Recently, the use of endoscopy has emerged as a powerful tool in the neuro-oncological surgeons' armamentarium. Endoscopes are ideally suited for use within the ventricular system and are now being applied to the removal of many other types of brain tumors. We present the cases of a series of patients with tumors of the third ventricle that have undergone treatment with either purely endoscopic removal or endoscope-assisted microsurgical removal to demonstrate that such techniques can be performed efficaciously and safely.

METHODS

The senior author's (CT) database was searched retrospectively to identify patients with tumors of the third ventricle. Each patient's presenting demographics, symptoms, objective and radiographic findings, treatment, histopathology, adjuvant treatments, outcome, and complications were recorded. Particular attention was paid to the role of the endoscope in the patients' surgical treatment.

There are several methods by which the endoscope is used to aid in the management of these tumors (23). Ventriculoscopy is invaluable for exploration of the ventricular system. The endoscope can be introduced via any portal, usually a right frontal burr hole, and navigated around the ventricles, looking for pathology that may have been silent on preoperative imaging (Fig. 4.1). Purely endoscopic tumor removal, where the endoscope is the sole means of visualization, and instruments are passed down a working channel, is used when the tumor is totally intraventricular, less than 2 cm in size, and relatively avascular. The colloid cyst is the perfect example of the purely endoscopic application (Fig. 4.2). Endoscopically controlled microsurgery, where the endoscope is the sole means of visualization but instruments are passed alongside the scope, not through working channels, is another technique that can be used to remove intraventricular tumors that are too large or too vascular for the purely endoscopic technique (Fig. 4.3). Finally, endoscopically assisted open surgery is a technique whereby the endoscope simply allows the surgeon to visualize anatomic and pathological structures that cannot be seen with the microscope. With this particular application, the tumor is removed using mostly standard microsurgical techniques. In the series described in this chapter, some form of endoscopy was used in every case.

RESULTS

Between January 1996 and February 2004, 120 patients were identified who fulfilled the study criteria. Average age at presentation was 22 years of age (range, 6 mo to 65 yr) and the male-to-female ratio was 75 to 45. The average length of follow-up was 34 months (range, 6 mo to 8 yr). All tumors were either primarily intraventricular, e.g., colloid cyst, or primarily intra-axial with exophytic extension into the third ventricle, e.g., central neurocytoma. There was a wide variety of tumors, but, as expected, the majority was colloid cysts (Table 7.1). Many different approaches were

used to gain access to the third ventricle (Table 7.2).

Of the 120 patients, 114 (95%) had a complete resection. This was observed by the surgeon and confirmed with postoperative magnetic resonance imaging (MRI). Patients with low-grade tumors had delayed scans (i.e., 6 wk after surgery) and those with malignant tumors were imaged within 48 hours of surgery.

Complications observed in the series included transient and permanent neurological deficits, and there were two perioperative deaths. One patient with a hypothalamic glioma did exceptionally well after surgery without neurological complications. She was discharged from the hospital 2 days after surgery and returned 2 weeks later with an apparent seizure. A computed tomographic (CT) scan showed no hematoma or hydrocephalus. She died that night from an unknown cause.

The other operative death was from a massive pulmonary embolus on postoperative Day 14 in a patient with a large third ventricular central neurocytoma (Fig. 4.4). Thirteen patients have subsequently died from progression of malignant disease. Three patients have had tumor progression. Of these, two patients had incomplete tumor resections of low-grade gliomas (Fig. 4.3), and one patient with a malignant teratoma had a radiologically confirmed complete macroscopic resection but the teratoma recurred 2 years after radiotherapy. He is still alive and well 5 years later. The surgical complications are listed in Table 7.3.

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DISCUSSION

The series of cases presented represents a heterogeneous group of patients who shared the common denominator of a tumor within the third ventricle. The aim of this chapter is not to compare the advantages of one technique over another but to illustrate the usefulness of a relatively new adjunct to the management of an extremely challenging group of patients. Although very few comparative conclusions can be drawn regarding the advantages of endoscopy over standard microsurgical techniques, there are several scenarios in which endoscopy is clearly invaluable. Examples are ventriculoscopic identification of tumor dissemination, endoscopic third ventriculostomy for secondary noncommunicating hydrocephalus, and purely endoscopic removal of colloid cysts and other suitable intraventricular tumors.

The use of endoscopes for inspection of the ventricular system (ventriculoscopy), tumor biopsy, and endoscopic third ventriculostomy is well documented in the literature. In the case of ventriculoscopy, diagnosis and treatment may change with the additional information provided as compared with imaging studies alone (15, 16). Likewise, for masses with an intraventricular component, endoscopic biopsy is a straightforward procedure to obtain a tissue diagnosis (5, 7–10, 17, 24). Endoscopic third ventriculostomy, depending on the underlying cause of hydrocephalus, has obvious allure, as opposed to shunting, with the inherent complications of shunting (19, 22, 25).

With the improved illumination, magnification, and field of view offered by the endoscope (14, 21), the progression of endoscopic techniques to intraventricular tumor removal and endoscopically assisted microsurgical resection was predictable (10, 12). The recent literature is testament to this evolving phenomenon.

Colloid cysts are the lesions most amenable to purely endoscopic removal. Lewis et al. presented a series of 15 patients harboring colloid cysts; with shorter operative times and hospital stays, and faster returns to work in those patients treated endoscopically versus those who underwent transcallosal resection (13). The series published by Abdou and Choen, King et al., and Rodziewicz et al. also demonstrated effective resections with low morbidity (1, 11, 18). In a series from Decq et al., with up to 28 months of follow-up, 1 of 15 patients had a cyst recurrence at 1 year (6). Thus, although the numbers of patients are small and there is not yet long-term follow-up, purely endoscopic resection can be the technique of choice. Unfortunately, much less is written regarding other tumor types.

Despite the advantages of endoscopy, the well-known, high-risk nature of surgery in the third ventricle is underscored by this series. Although most complications were temporary, when complications were permanent they were invariably devastating and had a strong negative impact on quality of life. This is a reflection of the sensitive and highly eloquent neural structures in juxtaposition to this area (2–4). In addition, as with any surgical technique, there is a learning curve associated with the use of endoscopes (20). Most of the serious morbidity occurs in those patients in whom the tumor involves, or is intimately related to, the midbrain.

CONCLUSIONS

Endoscopy is essential in the contemporary management algorithm of third ventricular tumors. It may identify radiologically silent intraventricular lesions, help in the re-establishment of cerebrospinal fluid pathways, enhance tumor removal, assess the extent of tumor removal, and totally replace the microscope in some cases. Despite these advantages, the high-risk nature of surgery in or around the third ventricle should not be ignored and is underscored in this surgical series.

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FIG. 4.1 MRI scans of a girl with recurrent central neurocytoma. Although the third ventricle looks slightly abnormal, the endoscope revealed a tumor that was significantly more extensive than the imaging suggested.
FIG. 4.2 A, this large colloid cyst was removed via a left frontal burr hole. The operative time was approximately 2 hours. B, the postoperative scan shows a complete resection. The patient was neurologically intact and discharged from the hospital 2 days after surgery.
FIG. 4.3 A, although this tumor was intraventricular, the size and vascularity prevented pure endoscopic removal. It was resected using endoscopically controlled techniques. B, postoperative MRI of the same patient showing incomplete resection of the tumor. The patient was neurologically intact and discharged from the hospital the day after the operation. He returned to the university and presented again 2 years later with a slight progression of his juvenile pilocytic astrocytoma.
FIG. 4.4 A, MRI showing a huge third ventricular central neurocytoma. The patient had quadriparesis and poor memory. B, the patient was recovering from surgery reasonably well until he died of a massive pulmonary embolus 2 weeks after surgery.