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Case Report

Non-brain-exposure Exoscopic and Endoscopic Volume Reduction Surgery for Benign Meningioma En Plaque in an Elderly Patient: A Case Report

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Meningioma en plaque (MEP) often needs invasive surgery to resect totally because of its widespread proliferation along the dura mater. We report a minimally invasive surgical technique for non-brain-exposure exoscopic and endoscopic volume reduction in an elderly patient with MEP. An 83-year-old woman presented with gait disturbance and cognitive dysfunction that had progressed over 6 months. Magnetic resonance imaging (MRI) revealed a large MEP on the right frontal lobe with peritumoral edema. On confirming the benign nature of the tumor (WHO grade 1) by biopsy, the main feeders and tumor were transarterially embolized. Volume reduction surgery was performed under the assistance of an exoscope and an endoscope while being careful not to expose and damage the cortex. Her symptoms completely resolved postoperatively. This surgical technique without exposing the brain may be a treatment choice for elderly patients with benign symptomatic convexity MEP.

Keywords: meningioma, en plaque, non-brain-exposure, exoscope, endoscope

Introduction

Meningioma en plaque (MEP) shows a flat, carpet-like proliferation along the dura mater and constitutes approximately 2.5% of all meningiomas.[1)] A higher risk of neurological morbidity after gross total resection has been reported for MEP treatment, and some recent studies have proposed intentional subtotal resection or volume reduction surgeries.[2–4)] In addition, postoperative complications and neurological deficits are more likely to be observed in the elderly than in the younger population.[5)] In the subgroup of elderly patients with convexity MEP, it would be ideal to alleviate mass effect on the brain without causing performance status decline. Herein, we present a case of an elderly woman with benign convexity MEP who underwent non-brain-exposure volume reduction surgery with an exoscope and an endoscope combined with transarterial feeder and tumor embolizations.

Case Presentation

An 83-year-old woman with gait disturbance and cognitive dysfunction that had progressed for over 6 months was referred to us from a Family Care Clinic. Neurological examination revealed left hemiparesis and mild cognitive dysfunction, with a score of 24 on the Mini-Mental State Examination (MMSE). Magnetic resonance imaging (MRI) showed a large dura-based tumor on the right frontal lobe, associated with marked peritumoral edema (Figs. 1a and 1b). Biopsy under local anesthesia revealed a meningothelial meningioma, WHO grade 1. Cerebral angiography and feeder embolization were then performed with the patient under local anesthesia. The tumor was primarily fed by the right superficial temporal artery (STA) and the right middle meningeal artery (MMA). The feeders that originated from the bilateral STAs and MMAs were embolized using n-butyl-2-cyanoacrylate and Embosphere Microspheres (Merit Medical Systems, South Jordan, UT, USA). After 2 days, volume reduction surgery was performed with the patient under general anesthesia. She was placed in a supine position and her head fixed in a Sugita head holder. Following a bicoronal skin incision (Fig. 2), with the aid of a neuronavigator, a right frontal craniotomy (5 cm × 6 cm) through the previously made burr hole was performed at the center of the attachment site of the tumor (Fig. 3). First, an exoscope (VITOM System; KARL STORZ, Tuttlingen, Germany) was used to perform internal decompression of the tumor (Fig. 4). A thin layer of the tumor was intentionally left on the arachnoid membrane, and no cerebrospinal fluid leakage was noted. Then, an endoscope (with viewing angles of 0° and 30° and a diameter of 4 mm; KARL STORZ) was introduced to resect the rest of the tumor located outside the edge of the craniotomy as much as possible (Fig. 5). Duraplasty with a periosteal patch was performed. The postoperative course was uneventful, and the majority of the tumor was removed (Fig. 1c). After rehabilitation, the patient's gait disturbance resolved completely, and she ultimately achieved a full score on the MMSE. Brain MRI performed 4 months after the surgery showed a remarkable shrinkage of the peritumoral edema (Fig. 1d).

Discussion

In general, the more radical the resection, the less frequently meningiomas recur.[6)] However, a recent study of meningiomas in elderly patients recommended an intentional subtotal

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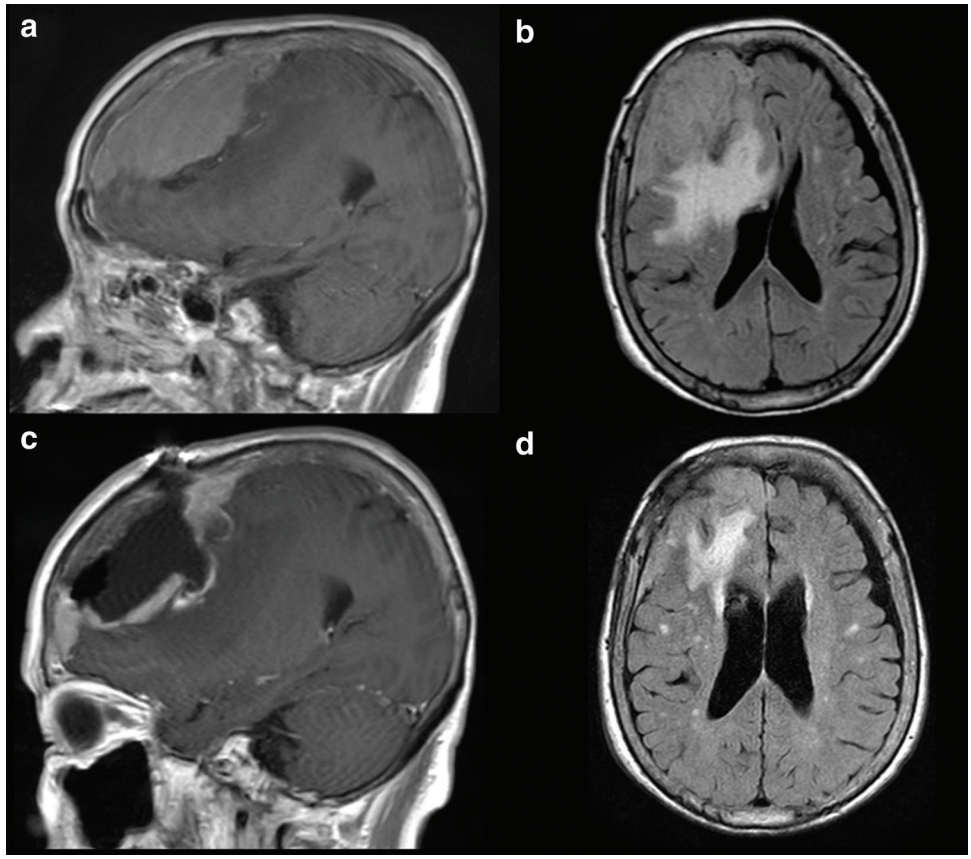

Fig. 1 Pre- and postoperative images of the tumor. (**a**) Preoperative sagittal gadolinium-enhanced T1-weighted MRI showing a thick MEP in the frontal region. (**b**) Preoperative axial FLAIR MRI, showing marked peritumoral edema and midline shift. (**c**) Sagittal gadolinium-enhanced T1-weighted MRI with gadolinium taken on postoperative day 6 showing successful tumor volume reduction. (**d**) Axial FLAIR MRI taken 4 months after the surgery showing resolution of mass effects of the MEP associated with reduced peritumoral edema. FLAIR: fluid-attenuated inversion recovery, MEP: meningioma en plaque, MRI: magnetic resonance imaging.

Fig. 2 An intraoperative view showing the extent of the bicoronal skin incision.

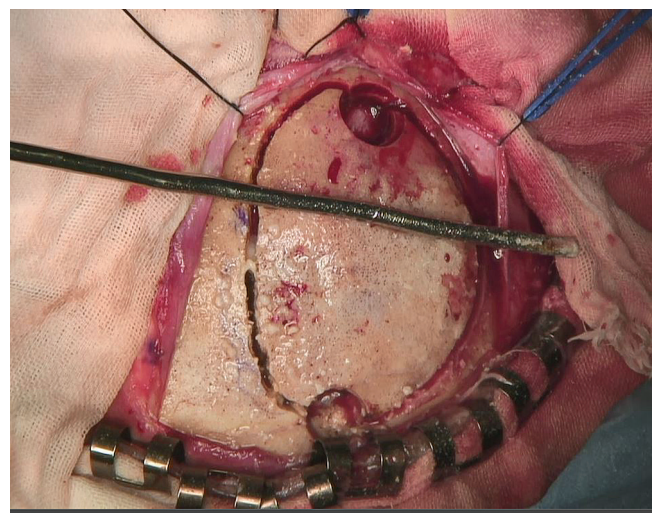

Fig. 3 An intraoperative view showing the right frontal craniotomy.

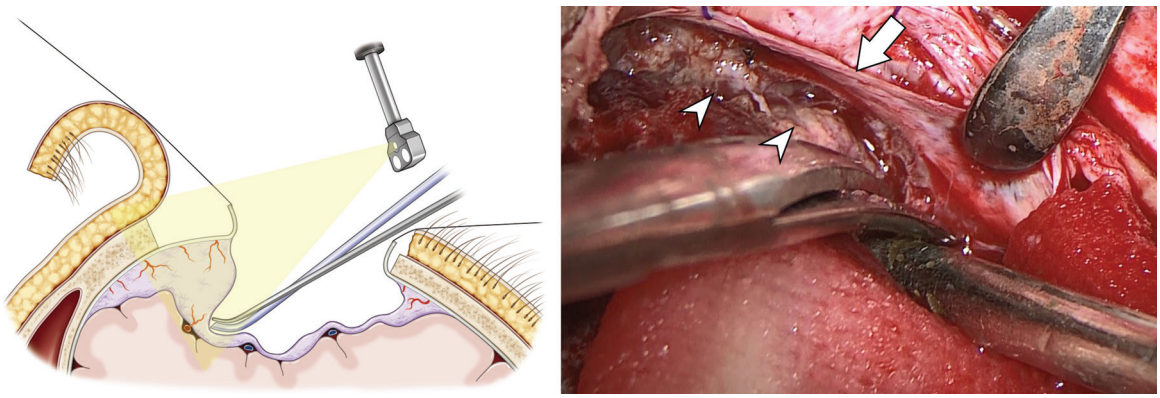

Fig. 4 A schema of the application of an exoscope to surgery for convexity MEP (left), and an intraoperative exoscopic view (right). An exoscope is useful to examine the subdural tumor (arrow heads) located outside of a relatively small craniotomy. (Dura: white arrow). MEP: meningioma en plaque.

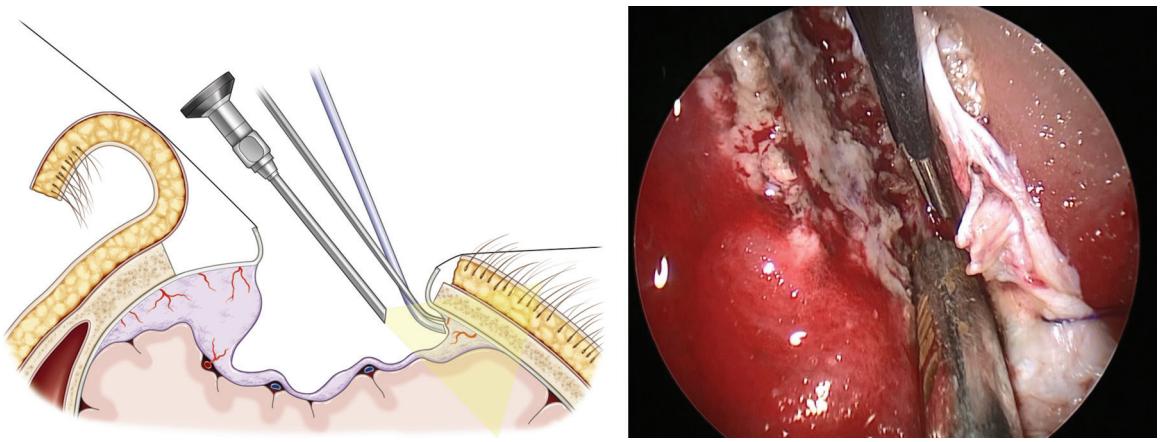

Fig. 5 A schema of the application of an endoscope to surgery for convexity MEP (left), and an intraoperative endoscopic view (right). An endoscope is useful to look in the upward direction the tumor beneath the dura located outside of a relatively small craniotomy. MEP: meningioma en plaque.

resection rather than a total resection to improve postoperative quality of life.[7] In the present case of MEP, which had a wide area of adhesion to the brain, we also considered safety and the degree of invasiveness and performed volume reduction surgery in a less invasive manner. To avoid postoperative performance status decline and seizure resulting from cortical injury, a layer of the tumor was intentionally left on the brain because it has been recognized that the superficial supratentorial location of meningiomas associated with brain edema poses the highest risk for early postoperative seizures.[8] Although a residual tumor may regrow, selection of the volume reduction tactic (Simpson grade IV) in the present case was justified by prior conformation of the benign nature of the tumor and blood supply eradication by embolization and resection of the central attachment, all of which was expected to provide a relatively long progression-free period for this patient who was 83 years old. When tumor volume reduction was effectively performed, a thin residual tumor layer began to transmit brain pulsation. This sign may be useful to intraoperatively judge the extent of safe resection.

The introduction of high-resolution endoscopes and exoscopes has made it possible to achieve significant tumor volume reduction in a manner less invasive than that of traditional microscopic surgery, that is, through a relatively small craniotomy at the center of the tumor. Owing to the versatility in handling the exoscope, surgeons can observe and resect a subdural tumor in all directions around the dural opening to some extent while standing in a neutral position. A blind spot in microscopic tumor resection is caused by an attachment located outside of the edge of a craniotomy, which would be easily captured with forward-oblique-viewing endoscopes. In the present case, a 30° endoscope was useful to look up and resect the tumor beneath the dura located outside of the craniotomy. A similar multiscope technique has been reported by our study group,[9] and, to the best of our knowledge, this is the first report utilizing a combination of an endoscope and an exoscope for MEP resection. The current shortcoming of endoscopes and exoscopes is the inability to provide perspective operative views; however, this concept is changing with the advent of three-dimensional technology. Experience with a larger number of cases is necessary to design appropriate craniotomies for exoscopic and endoscopic MEP removal that maintains a balance between effective volume reduction and minimal invasiveness.

Conclusions

As the combination of exoscope and endoscope enables non-brain-exposure volume reduction for MEP, this surgical technique may be a treatment choice for elderly patients with benign symptomatic convexity MEP.

Informed Consent

The patient has consented to the submission of the case report for submission to the journal.

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Conflicts of Interest Disclosure

All authors declare that they have no conflict of interest. All authors have registered online Self-reported COI Disclosure Statement Forms through the website for JNS members.

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