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Combined Endovascular and Surgical Treatment of High-Grade Meningioma - Case Report

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Abstract

Surgical resection of hypervascular meningiomas is often complex and may be accompanied by blood loss, followed by incomplete resection and tumor recurrence. We present a case of successful combined endovascular and surgical treatment for a large, complex, transcalvarial meningioma that is successfully resected. A 52-year-old male is admitted to our hospital with large left fronto-parietal tumefaction. Magnetic resonance imaging revealed extra-axial, transcalvarial fronto-temporal-parietal space occupying lesion with vivid contrast enhancement. Preoperative embolization was done using microspheres and coils. Surgical resection of tumor was done and pathohistology report showed Grade III meningioma. The patient recovers completely after the surgery and at first clinical follow-up 30 days later mRS was 0. Preoperative embolization of grade III meningioma reduces the surgery time, intraoperative blood loss and allows better resection without significant increase of perioperative complications. Reports on the association between embolization and tumor recurrence are insubstantial and require more research in future.

Introduction

Surgical resection of hypervascular meningiomas is often complex and may be accompanied by blood loss, followed by incomplete resection and tumor recurrence [1]. Even though preoperative embolization has generally been accepted as an adjuvant therapy that makes resection easier, the endovascular treatment is still controversial [2]. We present a case of successful combined endovascular and surgical treatment for a large, complex, transcalvarial meningioma that is successfully resected.

Case Presentation

A 52 years old male is admitted to our hospital with large left fronto-parietal tumefaction (Figure 1). Magnetic resonance imaging (MRI) with application of contrast media was done. Imaging revealed extra-axial, transcalvarial fronto-temporal-parietal space occupying lesion with vivid contrast enhancement (Figure 2). Mass was measured 7x10x8 cm. There is mild perilesional T2W hyperintensity in favor of perilesional edema. Midline shift to contralateral side measuring 6 mm. Using Seldinger technique right femoral approach was made, and six vessels selective digital subtraction angiography (DSA) was done. DSA revealed multidirectional blood supply of tumor coming from left external carotid artery (Figure 3). No blood supply coming from the left MCA was identified. Guiding catheter Envoi 5F (CERENOVUS, Johnson & Johnson Medical Co, US) was selectively introduced within left ECA.

Supraselective catheterization of feeding vessels was done using Prograde microcatheter system 2,8F (TERUMO Medical Co, Japan). Embolization done with Embosphere® (MeritMadical Co, USA) size 500-700 μm and Azur™ peripheral HydroCoil embolization system (TERUMO Medical Co, Japan) size 4x10 mm,

3x10 mm, and 2x4 mm. Follow up DSA revealed devascularization of tumor for more than 90% (Figure 4). Surgical resection of tumor was done 24 hours later (Figure 5). Duration of surgery was 3 hours and blood loss during the surgery was 800 ml. Pathohistological report revealed Grade III meningioma (Figure 6). The case was sent for further molecular testing by Oncomine Comprehensive assay (DNA and RNA), that revealed NF2: c.1396C>T, p.(R466*) non-sense mutation, which is likely oncogenic. Follow up MRI revealed complete tumor resection without residual tumor (Figure 7). The patient recovers completely after the surgery and at first clinical follow up 30 days later mRS was 0 (Figure 8). Three months after the surgery, the patient started radiation therapy 60 Gy/30Fx.

Figure 1: Patient with large fronto-parietal tumefaction.

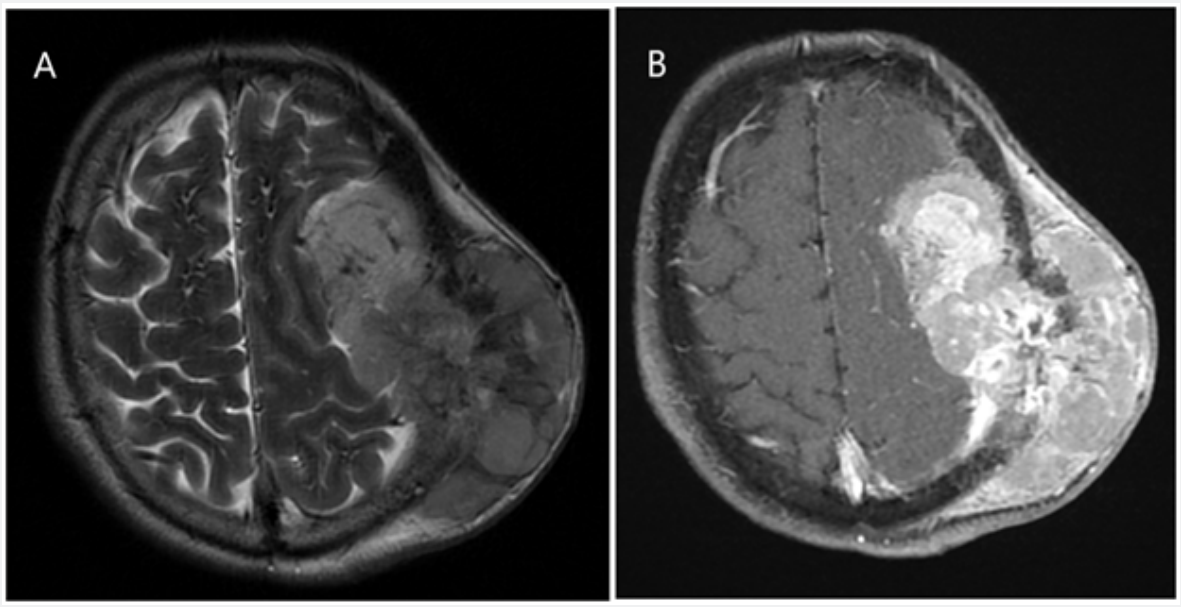

Figure 2: Magnetic resonance imaging (MRI): A) Axial T2W and B) Axial T1W postcontrast showing extra-axial transcarvarial fronto-temporal-parietal space occupying lesion with vivid contrast enhancement.

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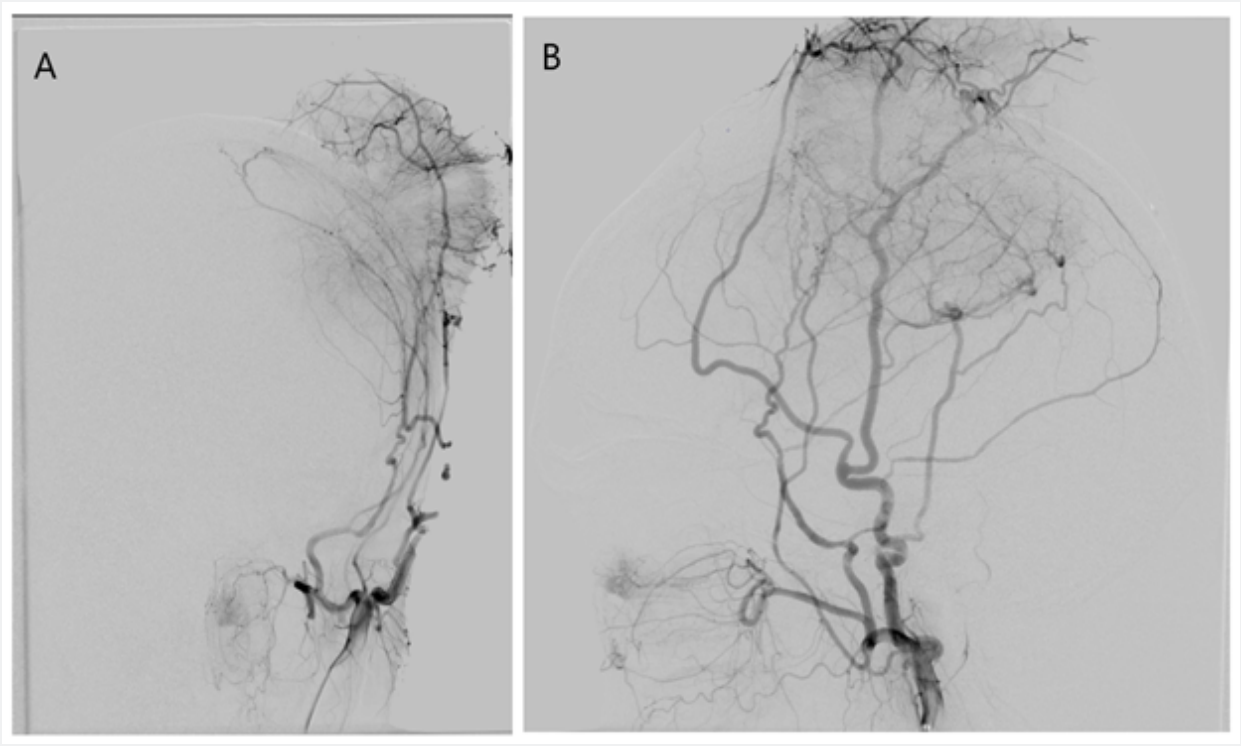

Figure 3: Digital subtraction angiography (DSA): A) Towns view B) Lateral view: Multidirectional blood supply of tumor coming from left external carotid artery branches.

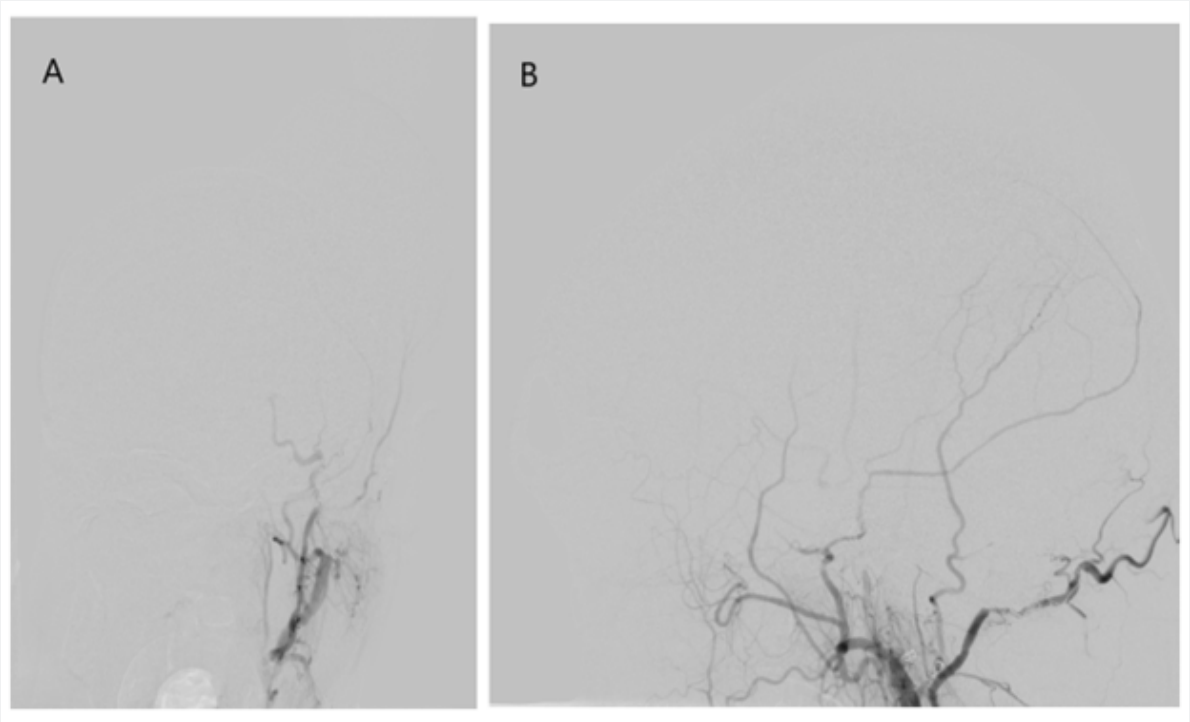

Figure 4: Digital subtraction angiography (DSA): A) Towns view B) Lateral view: Devascularization of tumor for more than 90%.

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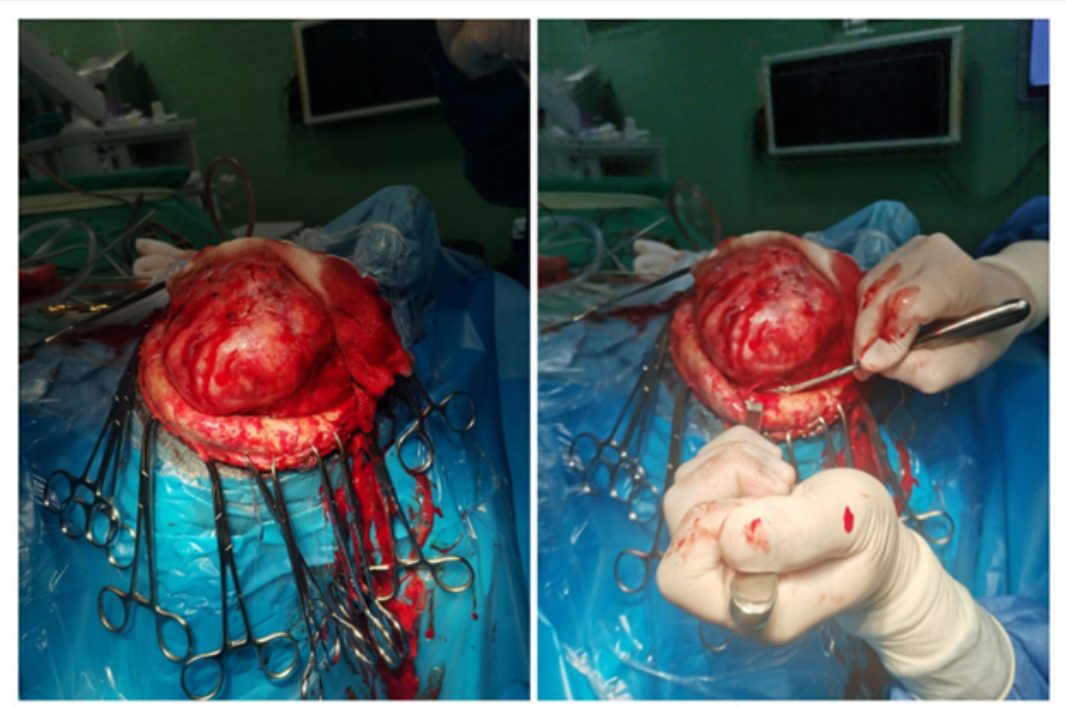

Figure 5: A) and B): Intraoperative findings.

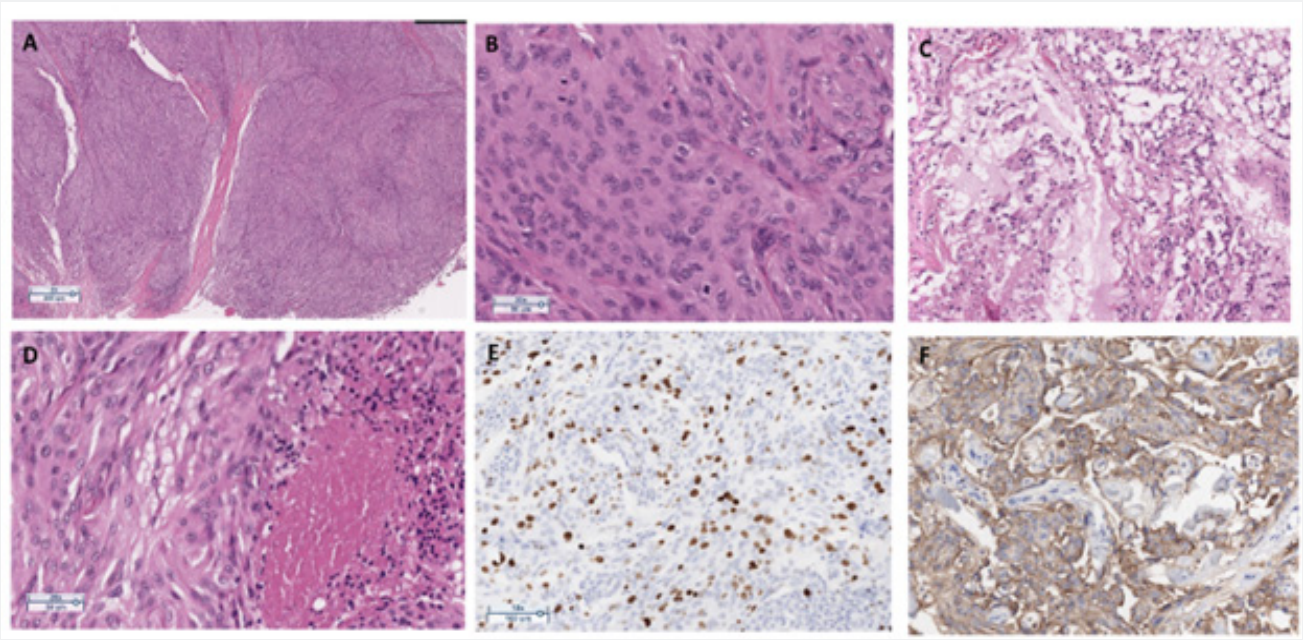

Figure 6: Histological features of the lesion. (A) Hematoxylin and eosin staining reveals a highly cellular nodular/lobular lesion arising from the leptomeninges. (B) On high power, the tumor has syncytial growth, nuclear grooves and frequent mitosis. (C) Tumoral foci show myxoid change. (D) Frequent tumor necrosis is present. The tumor has increased ki67 proliferation index (E), and express EMA (F).

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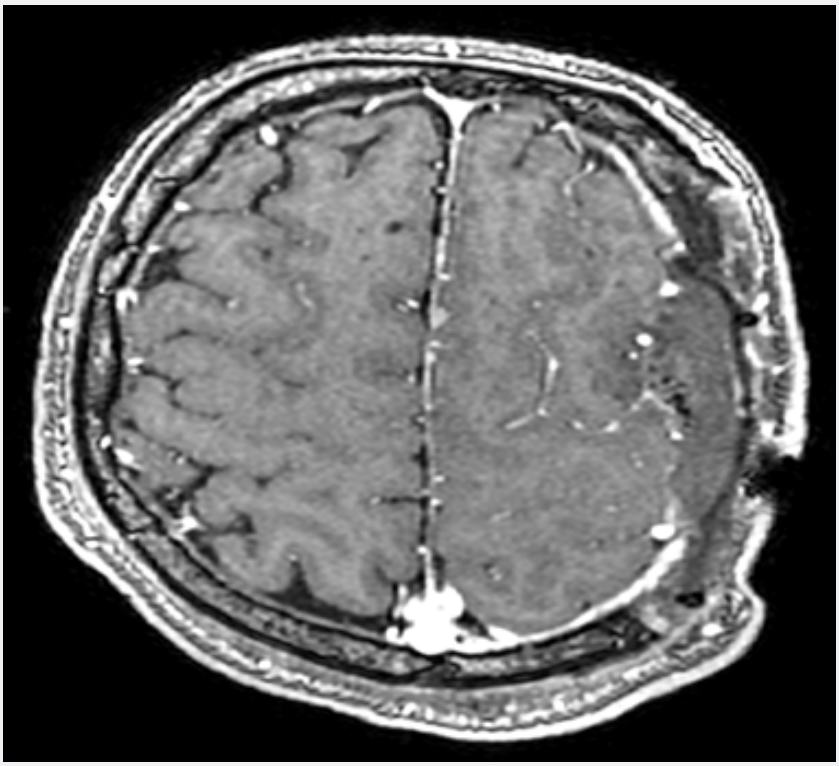

Figure 7: Magnetic resonance imaging (MRI) 30 days after surgery: Axial T1W with application of contrast media showing no residual tumor.

Figure 8: Patient 30 days after surgery.

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Discussion

Meningiomas are among the most common primary brain tumors, accounting for one third of all central nervous system tumors. It is estimated that more than 90% are WHO Grade, I, 5% are Grade II and 1-3% are Grade III [3]. Higher grade tumors commonly have higher vascularity and surgery may lead to intraoperative blood loss followed by incomplete resection and tumor recurrence [4]. Meningiomas mainly arise from the dura, and blood supply comes from meningeal arteries branching from external carotid artery. Although large and invasive Grade III meningioma can recruit blood supply from nearby arteries and even cerebral and cerebellar arteries [5]. Blood loss during the surgery of hypervascular meningioma depends on size and location and can range from 200 ml to 2,2 L. Our patient had large convexity grade III meningioma with multidirectional blood supply in which embolization has been shown to be most beneficial [6]. Blood loss during the surgery was 800 ml. There is much controversy regarding timing of embolization with respect to resection surgery [7]. Mostly the average time for surgery after embolization ranges from 1.9 to 6.3 days [8]. Considering that waiting too long may increase the risk of tumor hemorrhage and may increase the chance of recanalization of embolized vessels, surgery in our patient was done 24 hours after embolization procedure. Moreover, delayed resection after embolization of large tumors may cause tumor mass effect and lead to herniation and hydrocephalus which can affect the outcome [9,10]. Furthermore, studies analyzing duration of surgical resection of meningioma with and without preoperative embolization showed shorter operation time in embolized group with no significant difference in perioperative complication [11]. Duration of surgical resection in our patient was 3 hours and mRS at first follow up was 0. Moreover, some of the studies suggest that preoperative embolization might prolong the Grade I meningioma recurrence [12]. However, the evidence of combined endovascular and surgical treatment of Grade III meningioma recurrence has not been confirmed.

Conclusion

Preoperative embolization of Grade III meningioma reduces the surgery time, intraoperative blood loss and allows better resection without significant increase of perioperative complications. Reports on the association between embolization and tumor recurrence are insubstantial and require more research in future.

Author contributions

The first draft of the manuscript was written by Lazar Lazovic and all authors commented on previous versions of the manuscript.

Consent to participate

All authors read and approved the final manuscript.

Code availability

Code availability is not applicable to this article.

Conflict of Interest

The authors declare that they have no conflict of interest.

Consent to Publish

The patient provided written informed consent to publish this case report and any accompanying images.

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