Intracranial Hypertension Due to Meningioma of the Unique Transverse Sinus

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SUMMARY – We describe a 28-year-old woman with intracranial hypertension due to a meningioma invading the unique transverse sinus (with absent contralateral sinus). Clinical remission and normalization of orbital echography were obtained by resection of the intradural tumor and peeling of the dural attachment. In such cases, resection and reconstruction of the involved sinus segment is at high risk of venous infarction. Endovascular stenting of the obstructed sinus is a valid alternative when the stenosis is not remarkable. Single tumor removal may lead to partial sinus decompression and increased venous flow, resulting in long-term clinical remission.

Introduction

Intracranial hypertension may sometimes be due to impairment of blood flow through the intracranial venous sinuses by external compression or invasion by a variety of lesions. The sinus venous system is most vulnerable at the posterior end of the superior sagittal sinus and at the Torcular Herophili where the superior sagittal, straight and transverse sinuses are confluent¹. On the other hand, compression or invasion of a single transverse or sigmoid sinus may become symptomatic only when there is a significant dominance on one side.

We describe a rare case of intracranial hypertension due to a small meningioma obstructing the unique transverse sinus. The role of the pattern of venous sinus circulation and the management problems of this condition are discussed.

Case Report

A 28-year-old woman was observed in June 2008 for recent onset of headache, dizziness and transient blurred vision. Neurological examination was negative. Fundoscopic examination showed bilateral papilledema.

Magnetic resonance (Figure 1) revealed a small (2.5 cm) meningioma located at the junction

between the right transverse and sigmoid sinuses; invasion of the sinus junction was evident. MR angiography venous sequences confirmed the subtotal occlusion of the sinus lumen. The pattern of venous sinus circulation was of type D according to Hwang², i.e. a unique transverse sinus on the right (tumor side) coupled with agenesis of the left sinus; both the superior sagittal and straight sinuses drained into the unique right transverse sinus.

Intracranial pressure monitoring showed high values (24 cm H₂O). Orbital echography revealed an enlarged optic nerve sheath on both sides (5.4 cm on the right and 5.2 on the left).

Endoluminal venous sinus stenting was first considered, but it was not performed because of the technical difficulty due to the very narrow sinus lumen. Thus, surgical resection was decided.

Surgery through right lateral suboccipital craniectomy disclosed very enlarged transverse and sigmoid sinuses. The intradural tumor was removed and the dural attachment over the transverse-sigmoid sinus junction was peeled and coagulated. Temporary clamping of the transverse sinus resulted in sudden swelling of the cerebellar hemisphere and sinus itself. Thus, the involved sinus segment was not resected as it was considered at high risk, even using an intraoperative shunt. The postopera-

A

B

Figure 1 Preoperative MRI. A) Coronal T1W post contrast scan showing a meningioma of the right transverse-sigmoid junction area. B) Extensive invasion and subtotal occlusion of the sinus lumen.

tive course was uneventful, with no neurological deficits. Headache progressively improved and disappeared several days later.

At the clinical control three months after surgery, no symptoms of intracranial hypertension were present. Optic nerve echography showed normal values. Magnetic resonance (Figure 2) confirmed persistent sinus infiltration. Venous angiographic sequences disclosed a reappearance of the flow signal within the venous lumen of the involved sinus segment.

At the last follow-up at three years the patient is symptom-free with unchanged residual intrasinus tumor on MRI.

Discussion

The possible occurrence of intracranial hypertension secondary to a small lesion compressing or invading the transverse sinus has been known for many years³. In a case of a small “en plaque” meningioma infiltrating the left transverse sinus, Chazal et al.³ demonstrated an increase in venous pressure in the superior longitudinal sinus resulting in delayed CSF resorption at the arachnoid granulations and intracranial hypertension. This event has been described in association with different lesions, including Ewing sarcoma, metastatic tumors⁴, epidermoid cyst^{5,6}, eosinophilic granuloma¹, and meningioma^{7,8}. This may even result in the appearance of an acquired dural arteriovenous malformation of the transverse-sigmoid sinus region⁹ or peritumoral hemorrhage^{10,11}.

The most prominent features of the present case included the pattern of venous sinus circulation and the clinical outcome¹². The pattern of the venous sinus arrangement may be very variable. It has been known for many decades that a rather symmetrical venous drainage in both transverse sinuses occurs in no more than 65% of normal individuals¹³; in the others, one transverse sinus is dominant with the contralateral sinus being hypoplastic or absent¹³. More recently, Hwang et al.² attempted to classify the drainage pattern of the transverse and sigmoid sinuses in four types: type A with confluence and symmetrical transverse sinus (more than half of the cases); type B with confluence and non-dominant transverse sinus on the tumor side; type C with confluence and dominant transverse sinus on the tumor side; type D with a unique transverse sinus on the tumor side and contralateral agenetic sinus. The present case belongs to type D. According to this classification, intracranial hypertension may occur only in the rare type D cases and in type C cases with severe contralateral hypoplasia. This may explain the exceptional occurrence of cases associated with intracranial hypertension in spite of the high frequency of meningiomas invading the transverse or sigmoid sinuses.

The management of meningiomas invading the unique or largely dominant transverse or sigmoid sinus merits discussion. Resection of the meningioma and involved sinus with sinus

Figure 2 Postoperative MRI. A) Coronal T1W post contrast scan showing tumor removal and persistence of sinus infiltration. B) Reappearance of the flow signal within the venous lumen.

reconstruction is undoubtedly the ideal treatment¹⁴. The preoperative balloon occlusion test or jugular vein compression test and the intraoperative clamping test of the sinus with intravenous pressure measurement are useful aids to decide on sinus ligation and resection¹⁴. However, in cases of unique transverse sinus the increase in venous pressure after clamping test is greater than 7 mmHg and advises against sinus clamping and resection. In addition, where the meningioma lies at the transverse-sigmoid sinus junction, as in our case, reconstruction of the outflow of the superior petrous sinus is difficult.

In our patient intraoperative clamping of the transverse sinus resulted in sudden sinus and cerebellar swelling. Thus, sinus resection was considered at very high risk of venous infarction, even using a temporary shunt, because of the pattern of venous circulation. For this reason, we resected the intradural tumor and peeled the dural attachment without opening the sinus. This treatment resulted in clinical remission and normalization of the orbital echography, although the intrasinus tumor was still present. We suggest that decompression of

the obstructed sinus segment was sufficient to increase the intravenous flow.

Radiosurgery may be a useful adjuvant treatment for residual tumor nodules within the sinus lumen^{8,15}. However, it has a very delayed effect on tumor volume, and may be associated with postradiotherapy edema¹⁶. In addition, in cases with severe obstruction of a venous sinus the irradiation itself may precipitate sinus occlusion. Thus, we did not perform radiosurgery in our patient.

Recently, endoluminal venous sinus stenting was proposed as an alternative approach for treating focal stenotic lesions of the transverse sinus¹⁷. This endovascular technique has been realized in cases with idiopathic intracranial hypertension and bilateral transverse sinus stenosis¹⁸ and has proven to be beneficial in >50% of patients with no clinical deterioration¹⁶⁻¹⁷.

In our case the stenosis was considered too narrow to be treated by stenting. Although the long-term efficacy of this technique in sinus meningiomas has yet to be proven, we agree that endovascular sinus stenting followed by surgical resection of the intradural tumor is the best management in similar cases.

Conclusions

A meningioma invading the unique or largely dominant transverse sinus may cause an intracranial hypertension syndrome. In such cases, although resection and reconstruction of

the sinus segment involved is the ideal treatment, it carries high risk of venous infarction. Endoluminal venous sinus stenting is a valid alternative treatment. However, tumor removal leading to partial sinus decompression, and increased flow may result in clinical remission.

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