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Case Report

Endovascular treatment of idiopathic intracranial hypertension caused by multiple venous sinus stenoses

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ABSTRACT

Background: Idiopathic intracranial hypertension (IIH) shows symptoms by elevating intracranial pressure. Although sinus stenosis has been detected in many patients with IIH, the role of sinus stenosis in IIH remains obscure. Endovascular treatment for IIH due to transverse sinus stenosis has been frequently documented; however, IIH due to multiple sinus stenoses including the superior sagittal sinus (SSS) is rare. Here, we report a case of IIH due to multiple sinus stenoses treated by sinus stenting.

Case Presentation: A 47-year-old woman suffered from intractable headache with IIH presented with stenosis of the right transverse and SSS. Stent placement was carried out since intracranial hypertension and trans-stenotic cerebral venous pressure gradient (CVPG) were presented, and her intractable headache disappeared.

Conclusion: IIH can be caused by venous sinus stenoses and stent placement could be an appropriate treatment in patients who demonstrated a CVPG.

Keywords: Cerebral venous pressure gradient, idiopathic intracranial hypertension, sinus stenting, venous sinus stenosis

INTRODUCTION

Idiopathic intracranial hypertension (IIH) is a neurological failure caused by elevated intracranial pressure (ICP) in the absence of intracranial mass lesion.[14] This pathology is supposed to occur most frequently in young obese women and presents with chronic headache and papilledema.[7] IIH due to stenosis of multiple sinuses stenosis including the superior sagittal sinus (SSS) and transverse sinuses (TS) has rarely been reported. We herein report a patient who presented chronic intractable headache due to elevated ICP associated with multiple venous sinus stenoses. The presence of a cerebral venous pressure gradient (CVPG) can be a good indicator for stent placement, even in patients with multiple sinus stenoses.

Table 1: Sinus stenosis case reports performed intravascular treatment with cerebral venous pressure gradient.

Authors and year	Number/ mean age	Gender	Mean BMI	CSF opening pressure (cmH2O)	Mean pre-stent pressure gradient (mmHg)	Mean post-stent pressure gradient (mmHg)	location of stent placement	Complications	HA	PAP	VC	PT	Follow-up (months)
Higgins *et al.*, 2003	12/33.1	12F	36.9	33.7	18.9	5.75	NR	none	7/12	5/8	7/12	NR	14.1
Donnet *et al.*, 2008	10/41	8F, 2M	27.3	40.2	19.1	NR	TS9, bil-TS1	none	8/10	10/10	NR	NR	17
Bussiere *et al.*, 2010	10/34	10F	35.9	NR	28.3	11.3	NR	none	10/10	9/9	7/8	NR	20
Ahmed *et al.*, 2011	52/34	47F, 5M	30> in 47	32.9	19.1	0.6	TS48, none4	2 major, 2 minor	40/43	46/46	19/19	17/17	24
Kunpe *et al.*, 2012	18/38	12F, 6M	31.6	39.6	21.4	2.6	TS17, bil-TS1	1major, 2 minor	10/12	15/16	NR	NR	44
Randvany *et al.* 2013	12/-	11F, 1M	32.6	39.4	12.4	1.3	TS12	none	7/12	11/12	11/12	NR	16
Fields *et al.*, 2013	15/34	15F	39	NR	24	4	TS12, bil-TS3	1 minor	10/15	15/15	2/3	11/14	14
Ducruet *et al.* 2014	30/33	25F, 5M	NR	NR	NR	NR	NR	1 minor	18/26	NR	NR	NR	22
Our case	1/47	1F	31	34	27	15	TS, SSS	none	1/1	1/1	0/1	0/1	20

HA: headache resolution; PAP: Papilledema resolution; VC: Visual changes resolution; PT: Pulsatile tinnitus resolution

CASE PRESENTATION

A 47-year-old woman visited to our institute with a history of chronic intractable headache. Ophthalmologic evaluation demonstrated bilateral papilledema. We examined magnetic resonance (MR) venography depicted stenosis in the right transverse-sigmoid sinus and SSS stenosis [Figure 1a and b]. On MR imaging, hydrocephalus was considered unlikely [Figure 1c and d]. However, cerebrospinal fluid (CSF) was revealed with the optic nerve sheath on both sides, and there was enlargement of the Meckel caves bilaterally [Figure 1e and f]. We measured the CSF pressure by lumbar puncture demonstrated intracranial hypertension at 34 cm H_2O. Since conservatively treatment could not relieve the headache, we suggested ventriculoperitoneal shunt surgery, but the patient declined surgical therapy. We, therefore, planned endovascular stent placement for venous sinus stenosis after CVPG evaluation. Our planned strategy is described herein. If there was evidence of a venous pressure gradient in crossing the stenosis, we assumed this could potentially raise the CSF pressure. If we detected the pressure gradient crossing the stenosis ≥8 mmHg, we planned to perform placement of a stent according to the previous report.[11] Written informed consent form was received from the patient before the intervention.

Before endovascular treatment, the venous sinus pressure gradient was measured. The right internal carotid artery angiography revealed severe stenotic change in the right transverse-sigmoid sinus and SSS [Figure 2]. Using a 6 Fr destination guiding sheath (Terumo, Tokyo, Japan), an Excelsior SL-10 microcatheter (Stryker, Kalamazoo, Michigan, USA) was introduced to the parietal portion of the SSS, the TS, and the right internal jugular vein. The systolic venous pressure was 27 mmHg in the parietal portion of the SSS, 22 mmHg in the TS, and 8 mmHg in the right internal jugular vein. We placed sheaths in the artery and vein from a bilateral femoral approach. We placed a 6-Fr destination guide sheath in the right internal jugular vein. Percutaneous transluminal balloon angioplasty was carried out using a 4 mm × 40 mm Jackal (St Jude, Minnesota, USA) in the SSS. It was also performed using a 6 mm × 40 mm Jackal in the right TS. However, none of the venous pressure gradients improved, so we decided to place an 8 mm × 21 mm WALLSTENT (Boston Scientific, Marlborough, MA) stent in the right TSS at first. The venous pressure gradients indicated over 8 mmHg between distal and proximal of SSS stenosis after stenting in the right TS; however, we decided to place 8 mm × 29 mm WALLSTENT stent in the SSS [Figure 3a-d]. The systolic venous pressure was smaller than that of pretreatment. It was 15 mmHg in the parietal portion of the SSS, 13 mmHg in the TS, and 10 mmHg in the right internal jugular vein. No perioperative complications were observed. Her headache and papilledema were completely disappeared after the stents placement. Cerebral angiography 6 months after the procedure demonstrated good stents patency [Figure 3e-h].

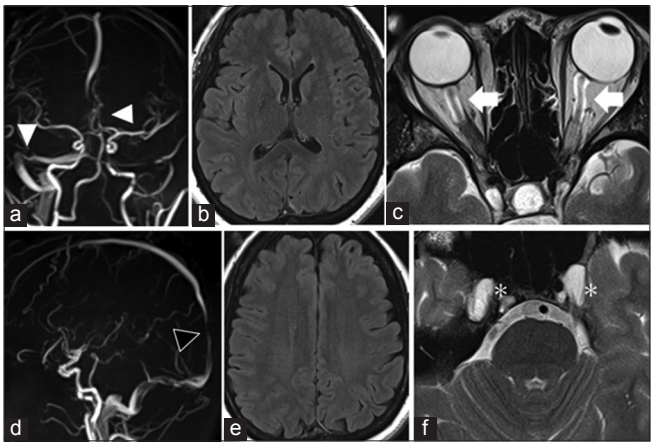

Figure 1: Magnetic resonance venography showed stenosis in the right transverse-sigmoid. (a) (White arrowheads) and in the superior sagittal sinus. (b) (Black arrowhead). On fluid-attenuated inversion recovery imaging, no ventricular enlargement or hydrocephalus is seen. (c and d). On T2-weighted imaging demonstrates accumulated cerebrospinal fluid in the bilateral optic nerve sheaths (white arrow). (e) And expansion of bilateral Meckel caves bilaterally (asterisk) (f).

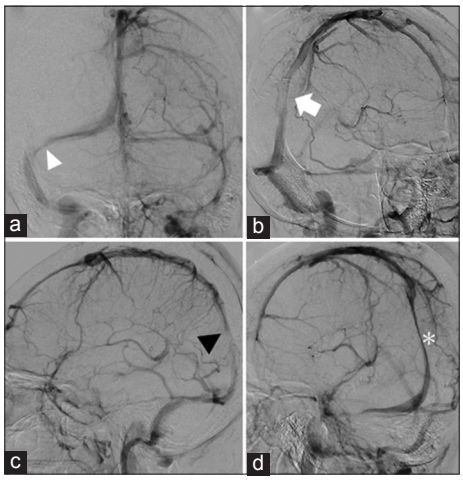

Figure 2: The left internal carotid artery angiography reveals severe stenosis in the right transverse-sigmoid sinus and superior sagittal sinus. (a) Anteroposterior view (white arrowhead). (b) Lateral view (black arrowhead). (c) Right anterior oblique view (white arrow), and. (d) Left anterior oblique view (asterisk).

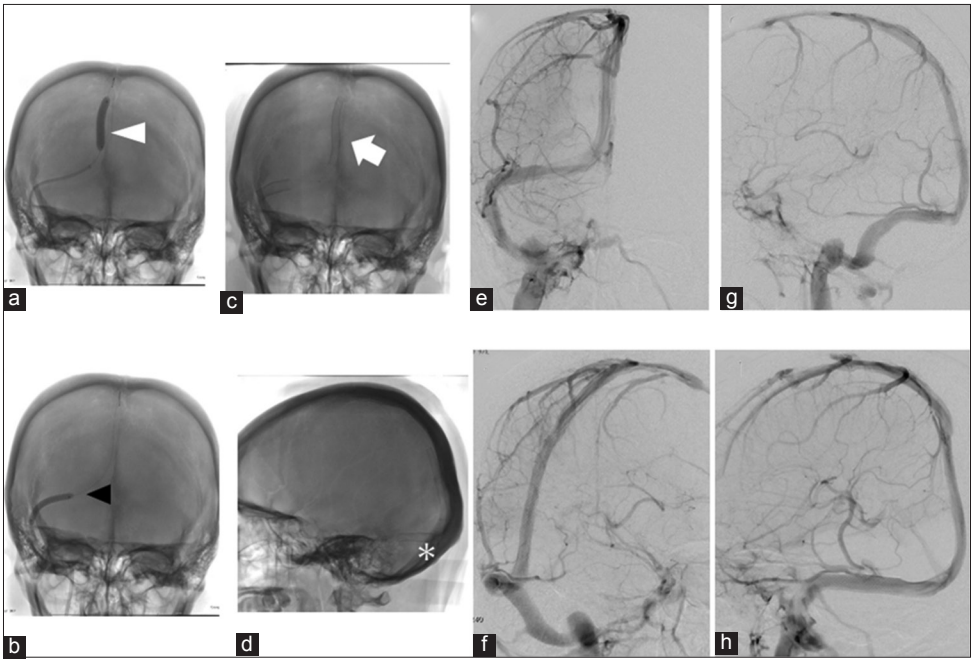

Figure 3: Percutaneous transluminal angioplasty was performed using a 4 mm × 40 mm Jackal in the superior sagittal sinus (SSS) (white arrowhead). (a) And transverse sinus (TS) (black arrowhead) (b). Stenting is performed in the SSS and right TS portion because each venous pressure gradient had not improved. (c) (White arrow). (d) (Asterisk). The right ICAG demonstrates satisfactory stent patency 3 months after the treatment. (e) Anteroposterior view. (f) Right anterior oblique view. (g) Lateral view; and. (h) Left anterior oblique view.

DISCUSSION

IIH often happens in young, obesity women who are between 20 and 50-year-old.[2] These patients often complain about severe headache. We often experience hardships for these patients to treat and then often operate multiple CSF shunting but do not get satisfactory pain control. The relationship between venous sinus stenosis and headache, especially associated with IIH, and the effect of venous sinus stenting for IIH have been established in several reports and meta-analyses.[5,11] Clinicians who perform endovascular procedures often use the presence of a CVPG to decide which patients could improve headache by placing

endovascular stent of the stenosis venous sinus.[1] Venous sinus stenosis might cause primary venous hypertension because the resultant elevated hydrostatic pressure disturbs CSF absorption in the arachnoid villi. However, other reports speculated that venous sinus stenosis might be the result rather than the cause of IIH.[11] Precise mechanism of IIH is still unsolved.

TSS stenosis is found on MRV in most patients with IIH, with a specificity of 93% and a sensitivity of 93%.[1] The stenosis can be a smooth, tapered narrowing due to extrinsic compression or a discrete intraluminal filling defect causing intrinsic obstruction or a combination of both. However, our patient presented with multiple sinus stenosis, including SSS stenosis. It is speculated that previous asymptomatic SSS thrombosis could be associated with SSS stenosis, and a continuous increase in CVPG would lead to IIH in the present case.

We found eight clinical reports in which intravascular therapy was used for venous sinus stenosis with CVPG [Table 1].[3,4,6-10,12] The patients who had a CVPG frequently had improvement in headache and papilledema after endovascular stenting. These results suggested, as previous reports had demonstrated, that the disappearance of the gradient with placing stent was effective to improve patients' symptoms. Furthermore, in all patients, transarterial angiography confirmed improved patency of an enhanced flow through the treated sinus. We detected SSS and the right TS had a CVPG at both stenotic sites, so we decided to perform endovascular therapy. CVPG at both sites was improved by stenting. Her symptoms were improved and her subsequent course has been uneventful.

Following MRI and MRV are important for an evaluation of instent restenosis after sinus stent placement because advent of instent restenosis has been recognized by some reports.[7] In a recent report, Smith *et al.* found an incidence of 35.7% of stent-adjacent stenosis in follow-up.[10,13] Further study is required to evaluate an effect of anticoagulant medical therapy avoiding instent restenosis after sinus stenting.

CONCLUSION

Endovascular treatment of sinus stenoses is an attractive attention over the past 10 years. We should consider stent placement to treat in patients not responding to anticoagulant therapy or CSF shunting.

Compliance with ethical standards

The procedures performed were in accordance with the ethical standards of the Institutional Ethics Committee and with the 1975 Helsinki declaration and its later amendments.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their 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.

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Conflicts of interest

There are no conflicts of interest.

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