Venous sinus stenting for Idiopathic Intracranial Hypertension treatment

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Venous sinus stenting (VSS) has been shown to reduce intracranial venous pressures and improve symptoms in patients with idiopathic intracranial hypertension (IIH). However, long-term follow-up data are limited, raising concerns about sustained symptom improvement

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VSS was independently associated with reduced odds of headache recurrence compared with VPS in multivariate analysis. Longer follow-up was significantly associated with headache recurrence in both groups. This suggests that VSS may lead to better outcomes for continued headache relief, but headache recurrence may increase with longer follow-up regardless of treatment modality. [1].

Idiopathic intracranial hypertension surgery paradigm may need to be re-examined with venous sinus stenting as a first-line treatment modality [2].

Idiopathic intracranial hypertension anatomical underpinnings remain unclear, but a stenosis at the junction of the transverse sinus and sigmoid sinuses has been recognized in the majority of patients through venography. The stenosis may result from intrinsic dural sinus anatomy or extrinsic compression by intracranial hypertension, but in either case, its stenting has been shown to lead to an improvement in symptoms of intracranial hypertension and papilledema in multiple retrospective, non-controlled studies. Prospective, controlled trials are needed to confirm its efficacy and safety [3].

Trials suggest that venous sinus stenting offers both comparable rates of efficacy - with improved papilledema in 97% of patients, resolved headache in 83%, and improved visual acuity in 78% .

Patients whose sight is threatened by medically refractory IIH must often consider invasive procedures to control their disease. Venous sinus stenting may offer equal efficacy and lower failure and complication rates than traditional surgical approaches such as optic nerve sheath fenestration and cerebrospinal fluid diversion [4].

Videos

<html><iframe width="560" height="315" src="https://www.youtube.com/embed/auxRg17F8yI" frameborder="0" allowfullscreen></iframe></html>

Reviews

2017

A systematic review of the surgical treatment of IIH was carried out. Cochrane Library, MEDLINE and EMBASE databases were systematically searched from 1985 to 2014 to identify all relevant manuscripts written in English. Additional studies were identified by searching the references of retrieved papers and relative narrative reviews.

Forty-one (41) studies were included (36 case series and 5 case reports), totalling 728 patients. Three hundred forty-one patients were treated with optic nerve sheath fenestration (ONSF), 128 patients with lumboperitoneal shunting (LPS), 72 patients with ventriculoperitoneal shunting (VPS), 155 patients with venous sinus stenting and 32 patients with bariatric surgery. ONSF showed considerable efficacy in vision improvement, while CSF shunting had a superior headache response. Venous sinus stenting demonstrated satisfactory results in both vision and headache improvement along with the best complication profile and low relapse rate, but longer follow-up periods are needed. The complication rate of bariatric surgery was high when compared to other interventions and visual outcomes have not been reported adequately. ONSF had the lowest cost.

No surgical modality proved to be clearly superior to any other in IIH management. However, in certain contexts, a given approach appears more justified. Therefore, a treatment algorithm has been formulated, based on the extracted evidence of this review. The traditional treatment paradigm may need to be re-examined with sinus stenting as a first-line treatment modality [5)].

2015

Kanagalingam et al., review the role of cerebral venous sinus stenting in the management of patients with medically refractory pseudotumor cerebri. Although long- term studies are needed in this field, the current reports indicate a favorable outcome for preventing vision loss and symptom control [6)].

2013

In 2013, a review of the literature was performed which identified patients with IIH treated with venous sinus stenting. The procedural data and outcomes are presented. A total of 143 patients with IIH (87% women, mean age 41.4 years, mean body mass index 31.6 kg/m(2)) treated with venous sinus stenting were included in the analysis. Symptoms at initial presentation included headache (90%), papilledema (89%), visual changes (62%) and pulsatile tinnitus (48%). There was a technical success rate of 99% for the stent placement procedure with a total of nine complications (6%). At follow-up (mean 22.3 months), 88% of patients experienced improvement in headache, 97% demonstrated improvement or resolution of papilledema, 87% experienced improvement or

resolution of visual symptoms and 93% had resolution of pulsatile tinnitus. In patients with IIH with focal venous sinus stenosis, endovascular stent placement across the stenotic sinus region represents an effective treatment strategy with a high technical success rate and decreased rate of complications compared with treatment modalities currently used [7].

Teleb et al., aimed to review all published cases and case series of dural sinus stenting for IIH, with analysis of patient presenting symptoms, objective findings (CSF pressures, papilledema, pressure gradients across dural sinuses), follow-up of objective findings, and complications.

A Medline search was performed to identify studies meeting pre-specified criteria of a case report or case series of patients treated with dural sinus stent placement for IIH. The manuscripts were reviewed and data was extracted.

A total of 22 studies were identified, of which 19 studies representing 207 patients met criteria and were included in the analysis. Only 3 major complications related to procedure were identified. Headaches resolved or improved in 81% of patients. Papilledema improved the (172/189) 90%. Sinus pressure decreased from an average of 30.3 to 15 mm Hg. Sinus pressure gradient decreased from 18.5 (n=185) to 3.2 mm Hg (n=172). Stenting had an overall symptom improvement rate of 87%.

Although all published case reports and case series are nonrandomized, the low complication and high symptom improvement rate make dural sinus stenting for IIH a potential alternative surgical treatment. Standardized patient selection and randomization trials or registry are warranted [8].

Case series

2017

Seventeen patients underwent dural venous sinus stenting (DVSS). Average pre- and post-intervention pressure gradients were 23.06 and 1.18 mmHg, respectively ($p < 0.0001$). Sixteen (94%) noted improvement in headache, fourteen (82%) had visual improvement and all (100%) patients had improved main symptom. Of 11 patients with optical coherence tomography, 8 showed decreased RNFL thickness and 3 remained stable; furthermore, these 11 patients had improved vision with improved papilledema in 8, lack of pre-existing papilledema in 2 and stable, mild edema in 1 patient.

This series of patients with dural sinus stenosis demonstrated improvement in vision and reduction in RNFL thickness. DVSS appears to be a useful treatment for IIH patients with dural sinus stenosis [9].

2016

Ten patients for whom medical therapy had failed were prospectively followed. Ophthalmological examinations were assessed, and patients with venous sinus stenosis on MR angiography proceeded to catheter angiography, venography with assessment of pressure gradient, and ICP monitoring. Patients with elevated ICP measurements and an elevated pressure gradient across the stenosis were treated with stent placement. RESULTS All patients had elevated venous pressure (mean 39.5 ± 14.9 mm Hg), an elevated gradient across the venous sinus stenosis (30.0 ± 13.2 mm Hg), and elevated ICP (42.2 ± 15.9 mm Hg). Following stent placement, all patients had resolution of the stenosis and

gradient (1 ± 1 mm Hg). The ICP values showed an immediate decrease (to a mean of 17.0 ± 8.3 mm Hg), and further decreased overnight (to a mean of 8 ± 4.2 mm Hg). All patients had subjective and objective improvement, and all but one improved during follow-up (median 23.4 months; range 15.7-31.6 months). Two patients developed stent-adjacent stenosis; retreatment abolished the stenosis and gradient in both cases. Patients presenting with papilledema had resolution on follow-up funduscopic imaging and optical coherence tomography (OCT) and improvement on visual field testing. Patients presenting with optic atrophy had optic nerve thinning on follow-up OCT, but improved visual fields. CONCLUSIONS For selected patients with IIH and venous sinus stenosis with an elevated pressure gradient and elevated ICP, venous sinus stenting results in resolution of the venous pressure gradient, reduction in ICP, and functional, neurological, and ophthalmological improvement. As patients are at risk for stent-adjacent stenosis, further follow-up is necessary to determine long-term outcomes and gain an understanding of venous sinus stenosis as a primary or secondary pathological process behind elevated ICP [10)].

El Mekabaty et al., retrospectively reviewed a prospectively maintained database spanning December 2011 to May 2015 of all patients with idiopathic intracranial hypertension who were screened for possible venous sinus stenting, including only patients who received a stent, noting symptomatic improvements, changes in opening lumbar puncture pressure, demographic characteristics, and any subsequent intervention after stent placement. Fisher's exact test and logistic regression were used to test each of seven potential predictors for retreatment. RESULTS: There were eight revisions in 31 patients (25.8%). Among Caucasians, 8.0% required a revision compared with 100% of African-Americans ($p<0.001$). The c-index for race was 0.857. Body mass index (BMI) was also a significant predictor of revision ($p=0.031$): among class III obese patients the revision rate was 46.2% compared with 16.7% among class I and II obese patients and 0% among overweight to normal weight patients.

BMI was a significant predictor of revision, suggesting that higher BMI may have a higher risk of revision. The small number of African-Americans in the study makes interpretation of the practical significance of the revision rate in these patients uncertain. None of the other studied factors was statistically significant. [11)].

A written informed consent approved by the Weill Cornell institutional review board was signed and obtained from the study participants. Thirty-seven consecutive patients with IIH and venous sinus stenosis who were treated with venous sinus stenting between Jan.2012-Jan.2016 were prospectively evaluated. Patients without pulsatile tinnitus were excluded. Tinnitus severity was categorized based on “Tinnitus Handicap Inventory” (THI) at pre-stent, day-0, 1-month, 3-month, 6-month, 12-month, 18-month and 2-year follow-up. Demographics, body-mass index (BMI), pre and post VSS trans-stenotic pressure gradient were documented. Statistical analysis performed using Pearson's correlation, Chi-square analysis and Fischer's exact test.

29 patients with a mean age of 29.5±8.5 years M:F = 1:28. Median (mean) THI pre and post stenting were: 4 (3.7) and 1 (1) respectively. Median time of tinnitus resolution post VSS was 0-days. There was significant improvement of THI (Δ Mean: 2.7 THI [95% CI: 2.3-3.1 THI], $p<0.001$) and transverse-distal sigmoid sinus gradient (Δ Mean: -15.3 mm Hg [95% CI: 12.7-18 mm Hg], $p<0.001$) post-stenting. Mean follow-up duration of 26.4±9.8 months (3-44 months). VSS was feasible in 100% patients with no procedural complications. Three-patients (10%) had recurrent sinus stenosis and tinnitus at mean follow-up of 12 months (6-30 months).

Venous sinus stenting is an effective treatment for pulsatile tinnitus in patients with IIH and venous sinus stenosis [12].

2013

Fields et al reviewed all cases of dural stents for IIH. Eligibility criteria included medically refractory IIH with documented papilledema and dural venous sinus stenosis of the dominant venous outflow system (gradient ≥10 mm Hg).

Fifteen cases (all women) of mean age 34 years were identified. All had failed medical therapy and six had failed surgical intervention. Technical success was achieved in all patients without major periprocedural complications. The mean preprocedural gradient across the venous stenosis was reduced from 24 mm Hg before the procedure to 4 mm Hg after the procedure. Headache resolved or improved in 10 patients. Papilledema resolved in all patients and visual acuity stabilized or improved in 14 patients. There were no instances of restenosis among the 14 patients with follow-up imaging.

In this small case series, dural sinus stenting for IIH was performed safely with a high degree of technical success and with excellent clinical outcomes. These results suggest that angioplasty and stenting for the treatment of medically refractory IIH in patients with dural sinus stenosis warrants further investigation as an alternative to LPS, VPS and ONSF [13].

Transverse sinus stenting for idiopathic intracranial hypertension

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