A Novel Treatment of Distal Cerebral Vasospasm

A Case Report

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Summary

A 22-year-old woman had an aneurysmal SAH due to a ruptured anterior communicating artery aneurysm and was treated successfully with endovascular coiling. The patient subsequently developed severe clinical and angiographically distal vasospasm. After failure of both medical treatment and proximal balloon angioplasty, the NeuroFlo™ device was tried and the patient showed substantial clinical recovery. We demonstrated an excellent outcome using a novel treatment for distal cerebral vasospasm with the NeuroFlo™ device.

Introduction

Cerebral vasospasm is the most common cause of mortality and morbidity post aneurysmal subarachnoid haemorrhage (aSAH)¹. There are two types of vasospasm, clinical or delayed ischemic neurological deficit (DIND) and angiographic vasospasm¹. The exact mechanism of the disorder is still poorly understood².

Recently, the NeuroFlo™ device (from CoAxia Inc, Maple Grove, Minnesota, USA) has been approved as part of the Safety and Efficacy of NeuroFlo Technology in Ischemic Stroke (SENTIS) trial where outcome in acute ischemic stroke is being assessed in those not eligible for IV or intra-arterial tPA. Its presumed mechanism of action is in blood flow di-

version to cerebral collaterals to minimize infarct volume and thereby improving clinical outcomes³.

There is a limited report on the utility of the NeuroFlo™ device as a treatment option in post SAH cerebral vasospasm in the English language literature⁴.

This case report describes a novel modality in the treatment of vasospasm using the NeuroFlo™ device.

Case Report

A 22-year-old woman was working out at the gym when suddenly she became unconscious and had a witnessed generalized tonic clonic (GTC) seizure. The patient was intubated and transferred to a local hospital where she had a head CT that revealed diffuse subarachnoid haemorrhage (SAH) (Figure 1A). Based on these results, the patient was transferred to our tertiary care center. On examination, the patient had stable vital signs, and was moving all four limbs to painful stimuli. Pupils were equal and reactive to light bilaterally.

The patient was admitted to the neuro intensive care unit (neuro ICU) with the diagnosis of WFNS grade 3 SAH⁵. A cerebral angiogram was obtained and revealed a 4 mm anterior communicating artery aneurysm which was amenable for endovascular coiling (Figure 1B).

To manage the acute hydrocephalus, the patient underwent external ventricular drain

(EVD) insertion. There were no complications from either procedure and the patient was extubated. On day five post SAH, the patient developed clinical symptoms and signs of severe vasospasm and transcranial Doppler monitoring showed diffuse vasospasm where the mean flow velocity (MFV) was 246 cm/second in the right ACA territory and 188 cm/s in the right MCA. She was initially treated with hypertensive and hypervolemic therapy but this failed to reverse her clinical deficit. This led to intracranial balloon angioplasty which was successful in achieving angiographic improvement in the proximal vasculature (Figure 1C) but distal vasospasm persisted (Figure 1D). The patient failed to improve clinically and the decision was made to try a novel treatment with the NeuroFlo™ device in the hope that it would improve distal perfusion.

A 9-French sheath in the right common femoral artery was used for access. Next, a 5-French pigtail catheter was placed in the abdominal aorta and the position of the renal arteries was identified.

The diameter of the aorta was measured 6 cm above and below the position of the renal arteries. The balloons were then inflated as per Sentis protocol to produce a 15 mm gradient

between the pressures in the upper abdominal aorta and the iliac artery. The balloons were inflated for the standard 40 minutes (Figure 1E). The patient clinically improved over the next 24 hours and no motor deficit was noted. The patient remained abulic for a few days but this resolved completely over the next three weeks. The patient continued to do well and was discharged home 29 days after her initial presentation (Figure 1F).

Discussion

We demonstrated excellent outcome and substantial recovery in our patient using a novel treatment of distal cerebral vasospasm with the NeuroFlo™ device after failure of maximal medical treatment and proximal intracranial balloon angioplasty. It is difficult to conclusively demonstrate that using the NeuroFlo™ device in this patient led to her avoidance of significant permanent ischemic neurological deficit. However, one wonders whether or not it at least contributed to her excellent outcome.

The NeuroFlo™ device has been implemented as an experimental tool for potential interventional treatment in non-IV t-PA responder patients with acute ischemic stroke. The pre-

Figure 1 A) Initial CT scan on presentation showing diffuse SAH in the basal cisterns. B) Digital subtraction angiogram (DSA): right internal carotid injection oblique projection showing 4 mm anterior communicating artery aneurysm. C) AP projection: right ICA injection showing severe distal ICA, ACA and MCA vasospasm. D) Post angioplasty angiogram shows proximal flow improved on the right side with persistence of distal VSP. E) Neuro-Flo balloon in place. F) CT head 3 weeks post NeuroFlo™ balloon showing no evidence of stroke.

sumed mechanism of action is enhancement of blood flow diversion to cerebral collaterals to minimize infarct volume and improve clinical outcomes^{3,6}. In 2005 Lylyk et Al published the first paper describing the results of NeuroFlo™ device use in cerebral vasospasm treatment⁴. Lylyk et Al treated 24 patients with cerebral vasospasm after aSAH. The NeuroFlo™ was inserted in the femoral artery and the total inflation time of the balloons was 60 minutes.

They reported a 15% increase in the mean flow velocity in both middle cerebral arteries in 20 patients (83%)⁴.

Intra Aortic Balloon Counterpulsation

(IABC) is another endovascular method used in the treatment of cerebral vasospasm^{7,8}. From a theoretical point of view, we believe the NeuroFlo™ has many advantages over IABC since it does not require ongoing anticoagulation and also potentially fewer local insertion site complications since it is in place for a shorter time period^{7,8}. A further pilot study is needed to support the concept of the NeuroFlo™ device for proximal and distal vasospasm after aneurysmal SAH.

In conclusion, the NeuroFlo™ device appears to be a promising new technique in the management of distal cerebral VSP.

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