

Everything but the Kitchen Sink to Treat Refractory Vasospasm: Alternative Treatment Options

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Everything but the Kitchen Sink to Treat Refractory Vasospasm: Alternative Treatment Options

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Abstract

The mortality rate of aneurysmal subarachnoid hemorrhage (aSAH) can be as high as 70 percent. Of patients whom survive, 25-30 percent develop some degree of vasospasm up to 21 days after initial onslaught. Vasospasm is the second leading cause of death and disability in patients with subarachnoid hemorrhage (SAH). The American Stroke Association (ASA) guidelines for management of SAH recommend oral Nimodipine and endovascular treatments to limit detrimental effects of vasospasm. In patients with severe, unrelenting vasospasm, outcomes within an academic, community Magnet® hospital have shown promising results when implementing alternative therapies after radiographic evidence that vasospasm is not resolving by endovascular intervention. This presentation details the pathophysiology of vasospasm, outlines ASA guidelines for treatment of aSAH, and uses two case studies to present alternative treatment options including targeted temperature management, intravenous Milrinone, low dose Nicardipine infusions, and intra-thecal medication administration.

Objectives

1. Outline the published American Stroke Association guidelines for the management of aSAH.
2. Discuss the pathophysiology of vasospasm in the aSAH patient.
3. Detail two case studies that demonstrate that the addition of targeted temperature management cooling, intravenous Milrinone, intravenous low-dose Nicardipine and intra-thecal medication administration may be adjunct therapies in angiographic vasospasm limiting the severity of the spasm and improving patient outcomes.

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Management of aSAH

1. aSAH affects 30,000 people annually in the United States
 - a. Location of aneurysm is a prognostication of survival and potential neurological deficits
2. Clinical manifestations and diagnosis of aSAH
 - a. Complaint of “worst headache of my life”
 - b. Sentinel bleed or warning leak
3. Surgical and endovascular methods for treatment of ruptured aneurysms
 - a. Surgical clipping in patients with large (>50 mL)
 - b. Surgical clipping recommended for wide base aneurysm
 - c. Endovascular coiling patients > 70 years of age
 - d. Endovascular coiling consideration in aneurysms if in the basilar apex
4. Management of cerebral vasospasm and delayed cerebral ischemia
 - a. Oral Nimodipine should be administered to all patients with aSAH
 - b. Maintenance of euvolemia and circulating blood volume
 - c. Induction of hemodynamic augmentation to improve cerebral perfusion
 - d. Cerebral angioplasty and/or intra-arterial vasodilation

Management of Cerebral Vasospasm and Delayed Cerebral Ischemia

1. Any neurological deterioration presumed to be related to ischemia that lasts for more than one hour
 - a. Angiographic narrowing of arteries
 - b. Elevated cerebral blood flow velocities
 - c. Occurs 7 to 10 days after rupture and resolves spontaneously after 21 days
 - d. Major cause of death and disability
2. Oxyhemoglobin comes in contact with the abluminal side of a vessel
3. Depletion of nitric oxide causes cerebral vasoconstriction
4. Free radical oxidation of bilirubin stimulates vasoconstriction
5. Inflammation and leukocyte adherence to the vascular endothelium
6. Presence of cytokine proteins in the vasculature



Case Studies

- 1 Hunt and Hess grade 4, modified Fisher 4 subarachnoid hemorrhage secondary to a ruptured left anterior communicating artery aneurysm in a 29-year-old female**
 - a. Coil assisted embolization with secured aneurysm
 - b. Hemi-craniotomy with external ventricular device (EVD)
 - c. Symptomatic vasospasm on day #4
 - Intra-arterial Verapamil administration
 - d. Symptomatic vasospasm of internal carotid arteries and middle cerebral arteries
 - Daily to Interventional Radiology
 - e. Vasospasm/cerebral edema unrelenting leading to adjunct treatment options
 - Intrathecal nicardipine
 - Serum NA goal 155-160
 - Intravascular cooling
 - Low dose Nicardipine infusion
 - Intravenous Milrinone infusion
 - Medically induced (pentobarbital) coma on day #16
 - f. Discharged to rehabilitation hospital after 38 days

- 2 Hunt and Hess grade 3, modified fisher 4 subarachnoid hemorrhage secondary to ruptured posterior communicating aneurysm rupture in a 57-year-old female**
 - a. Aneurysm clipped on day #1
 - b. Vasospasm on hospital day #4
 - Middle cerebral artery and bilateral internal carotid artery
 - c. Interventional Radiology for IV Verapamil X 10 consecutive days
 - d. Received continuous low dose Nicardipine as an adjunct therapy
 - e. Received intravascular targeted temperature management
 - f. Chemically paralyzed to optimize ventilation and impact shiver threshold
 - g. Tracheostomy and percutaneous endoscopic gastrostomy (PEG) on day #28
 - h. Transfer to medical-surgical unit on hospital day #33
 - i. Transfer to inpatient rehabilitation unit on day #45
 - j. Discharge home with husband on day #66

