

What did I learn from my last case of Cerebral Hyperperfusion Syndrome?

Gary M Ansel MD
System Medical Chief: Vascular
OhioHealth
Columbus, Ohio
USA

Disclosure

Speaker name: Gary Ansel, MD

I have the following potential conflicts of interest to report:

Consulting Medtronic, BSC, Cook Med. WL Gore, Abbott Vasc. CR Bard, Phillips

Employment in industry

Stockholder of a healthcare company

Owner of a healthcare company

Other(s)

Royalties: Cook Medical,

I do not have any potential conflict of interest

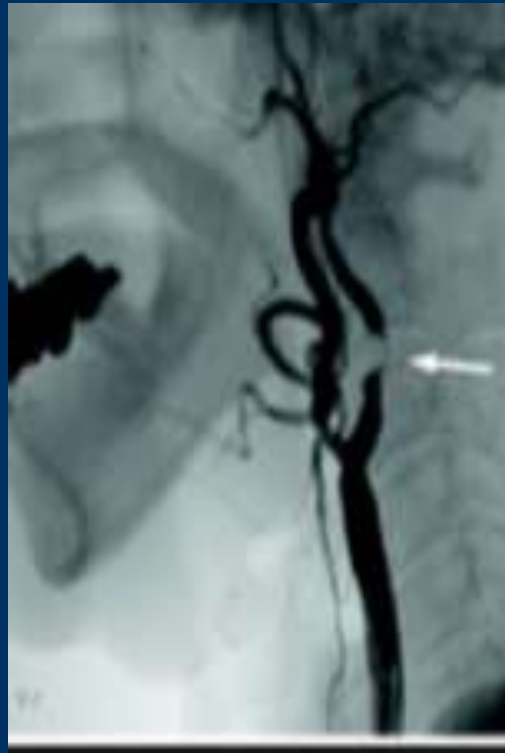
Great Case Bad Outcome: CAS

- 72 year old patient
- Hx of CAD, HTN, DM
 - BP meds = Beta blocker, Ca⁺ blocker and diuretic
- Known chronic occlusion of Right Carotid artery
- Now presents with intermittent near syncope and right arm weakness
- BP on admission 185/98

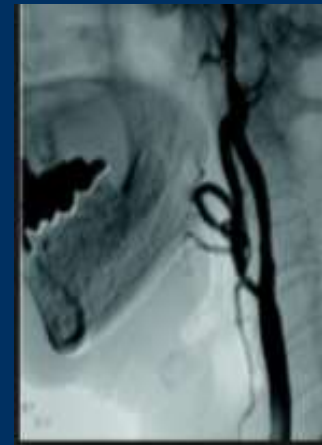
Baseline Angiogram of Lt ICA



Decision to Treat With Carotid Stent



Case Details



- **Distal protection utilized**
- **Came to the procedural unit with some continued hypertension 180/90 (BP meds held)**
- **Post stent did not drop BP or become bradycardic**
- **BP controlled with IV NTG with goal < 160mmHg**
- **Placed back on home meds and by next afternoon discharged with BP of 152/85**

Post Discharge Course

- Called into the clinic with complaint of sore neck and mild to moderate headache
- Instructed by staff to check for neck swelling and to acetaminophen ok to use for headache
- Third day became unresponsive and squad called
- Patient found to have intracranial hemorrhage neurosurgery consulted but family decided to not pursue heroics. Pt died next day.

CT Scan 72 hours
post carotid stent





So What Did I Learn

Hyperperfusion syndrome

- Failure of normal cerebral autoregulation, secondary to long-standing changes in perfusion pressure
- Maximal dilation of cerebral arterioles for long periods of time causes loss of cerebral blood flow autoregulation in areas of chronically underperfused brain tissue and can result in hemorrhage and/or edema



Compliment Nick Hopkins
MD

Hyperperfusion Syndrome

May be acute
May be delayed



Hyperperfusion Syndrome and CAS

- **Hyperperfusion: sudden increase CBF after CEA/CAS usually >100% (incidence approx 1.9%)***
- **Syndrome occurs also in the presence of relative hyperperfusion of the ipsilateral hemisphere, ranging from 20 to 44% increased CBF (incidence 0.37%)***
- **CT Perfusion and TCD have been used to diagnose**

*Moulakakis KG, J Vasc Surg 2009;49:1060-8.

Hyperperfusion syndrome

- Risk factors for hyperperfusion syndrome:
 - Sudden increased perfusion in a chronically ischemic hemisphere
 - Severe stenosis or bilateral carotid artery stenosis
 - Previous stroke/ischemia
 - Periprocedural/long standing hypertension
 - Poor collateral blood supply
 - Reduced preoperative cerebrovascular reactivity

Hyperperfusion syndrome

- **Risks factors for intracranial hemorrhage once hyperperfusion syndrome exists:**
 - The use of anticoagulant & antiplatelet agents
 - Preprocedural cerebral infarctions
 - Preexisting hypertensive microangiopathy
 - Aggressive antiplatelet therapy (periprocedural use of glycoprotein IIb/IIIa inhibitors)

Clinical presentation of Hyperperfusion Syndrome

- seizures in 36%
- hemiparesis in 31%
- both in 33% of patients
- Sever HTN at onset 81%
- Hours to days

Meta analysis of Cerebral Hyperperfusion CEA

- Results: 36 studies were identified
 - CEA:
 - incidence of severe hypertension 19%
 - cerebral hyperperfusion 1%
 - ICH 0.5%
 - mean systolic blood pressure of patients, who went on to develop cerebral hyperperfusion syndrome, was 164 mmHg
 - cumulative incidence of cases rose appreciably above a postoperative systolic blood pressure of 150 mmHg.

Meta analysis of Cerebral Hyperperfusion CEA

- Results: 36 studies were identified
 - CEA:
 - The incidence of cerebral hyperperfusion in the first week was 92% with a median time to presentation of 5 days.

Control Of BP is Essential

- BP control
 - Reduced odds when BP 140-160
 - No published cases of with BP < 135
 - Theoretically Labetolol and clonidine optimal
 - Vasodilators such as NTG and Nitroprusside may worsen already profound autoregulation problem

Anti-hypertensives to Avoid

- calcium channel blockers
- sodium nitroprusside
- Nitrates
- angiotensin II inhibitors

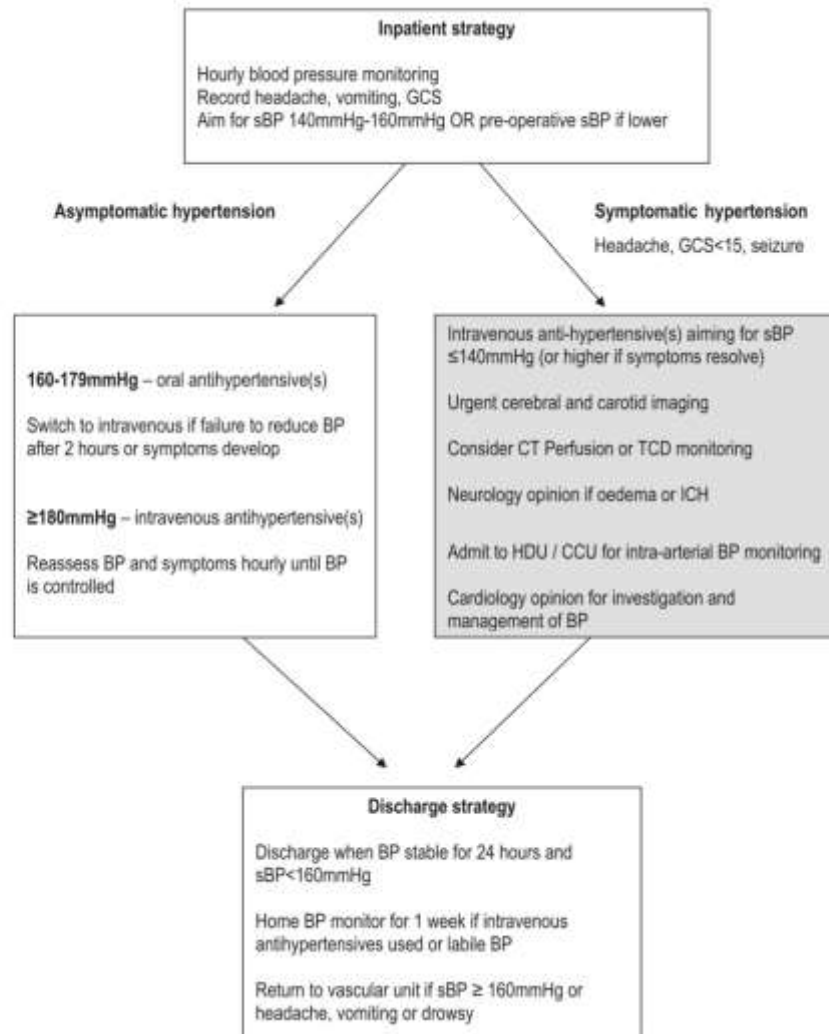
Anti-hypertensives to Consider

- **Beta Blockers**
- **Mixed alpha-adrenergics/beta blocker (labetolol)**
- **Central actingssuch as Clonidine**

Key Factor prevention and Treatment Summary

| Treatment modality | Comment |
|---------------------------------------|--|
| Blood pressure control | <p>Strict control of blood pressure is recommended</p> <p>Lower blood pressure even in normotensive patients</p> <p>There are no definite guidelines about blood pressure parameters and management should be individualized</p> <p>Avoid medications which have vasodilatory effect such as calcium channel blockers</p> <p>Labetalol and clonidine are better options to treat elevated blood pressure in these patients</p> |
| Timing of carotid surgery | <p>Carotid endarterectomy or stenting should be done within 2 weeks of transient ischemic attack or stroke</p> <p>Patient is at risk of cerebral hyperperfusion syndrome if they underwent contralateral carotid endarterectomy in past 3 months</p> |
| Type of anesthetic | <p>High doses of volatile halogenated hydrocarbon anesthetics may lead to cerebral hyperperfusion syndrome</p> <p>Isoflurane is safer to use in these patients but can cause complications at higher doses</p> <p>Nitrous oxide is also safe but should not be used with isoflurane</p> <p>Propofol normalizes cerebral blood flow and is a safe option</p> |
| Use of anti-epileptic medications | <p>Prophylactic use of an anti-epileptic drug is not recommended</p> <p>If patient has lateralized epileptiform discharges or a clinically manifest seizure spell, an anti-epileptic drug may be administered</p> |
| Use of hypertonic saline and mannitol | <p>The evidence about the use of hypertonic saline and mannitol is not strong but may be administered if the patient has cerebral edema</p> <p>Corticosteroids and barbiturates are not indicated in most cases</p> <p>Hyperventilation and sedation may be administered if the patient has cerebral edema</p> |

Strategic Flow Chart



Summary

Better to Prevent Than Try to Treat



What did I learn from my last case of Cerebral Hyperperfusion Syndrome?

Gary M Ansel MD
System Medical Chief: Vascular
OhioHealth
Columbus, Ohio
USA