Managing Subarachnoid Hemorrhage

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Subarachnoid Hemorrhage Facts

- 80% Caused by rupture of an intracranial aneurysm
- 20% Not caused by aneurysm (AVM, Tumor) carry a good prognosis and less neurological complication
- 46% of Survivors may have a long-term Cognitive Impairment

Aneurysm Facts

- Aneurysm is a weak spot in a blood vessel
- Rupture leaks blood into subarachnoid space
- 30,000/year in North America

Aneurysm Facts (cont.)

- Most deaths occur within the first two weeks
- 1/3 die before hospital, of remaining, 1/4 die within first 24 hours after the event, 1/3 have permanent problems
- 2-4% will re-bleed in first 24hr
- 15-20% will re-bleed in the first week
- Women:men ratio is 2:1
- 10-12 million people have aneurysms with 50-80% don’t rupture

Theory?

- Decrease in the tunica media (middle layer or the artery) causing structural defect
- Smoking and HTN cause vascular changes that lead to weakening of the vessel wall
Mycotic Aneurysm

- Aneurysm due to weakness of the adventitia second to septic Emboli (bacterial endocarditis).
- Tiny septic emboli occlude the vaso vasorum or entire lumen, destroying the muscular layer through secondary infection.
- Leads to weakening of the vessel wall.

Grading

- Hunt and Hess Scale
  - Grade 0: unruptured
  - Grade 1: SAH asymptomatic/minimal headache
  - Grade 2: Severe headache, nuchal rigidity, 3rd cranial nerve deficit
  - Grade 3: Drowsy with minimal deficit
  - Grade 4: Stuporous, hemiparesis
  - Grade 5: Coma, extensor posturing

Diagnosis

- Clinical history of sudden, severe headache, LOC,N/V
- CT to identify SAH, hydrocephalus

Fisher Grading System (I-IV)
Fisher Scale

- Grade 1: No hemorrhage evident
- Grade 2: SAH <1mm thick
- Grade 3: SAH >1mm thick
- Grade 4: SAH any thickness with IVH involvement

Note: Thick blood clot and bilateral ventricular hemorrhage are both poor outcome predictors

Diagnosis (cont.)

- CT-A, Cerebral Angiogram or MRA to identify source of hemorrhage

CT-A vs. Angiogram vs. MRA

- CT-A is quicker, less invasive (less risk), less expensive, provides adequate 3D views but requires contrast load, carries allergy risk, depends on tech quality
- CTA first – younger, good grade, anterior circulation aneurysm
- DSA first – older, poor grade, posterior circulation aneurysm, patients with renal failure and/or a CT scan that seems unlikely to show an aneurysm
- MRA takes 30-60 minutes and more difficult with critical patients

Diagnosis Pitfalls

- Order CT with “thin cut.” Small amounts of blood can be missed on regular CT
- HA May be the only sign and symptom in 40% of cases
- Diagnosis is missed up to 50% on initial physician visits (migraine or tension HA)
- Angiogram fails to dx 10-20%
  - Follow up angiogram 1-6 weeks
Diagnostic (cont.)

- Lumbar Puncture
  - Used for patients that are CT negative but clinical signs of SAH are present
  - Look for elevated opening pressure, elevated RBC that don’t fade from tube 1-4
  - Presence of Xanthrachromia (break down of RBC detected by spectroscopy). May take more than 12hr to develop
  - True vs. Traumatic Tap

Definitive Treatment

- Aneurysm secured by:
  - Clipping
  - Coiling

Clipping

- Requires Craniotomy and placement of permanent MRI safe clips
- Manipulation of Brain Tissue

Coiling

- Involves Guiding of catheter into the vessels of the brain
- Detachable coils are placed into the aneurysm
  - Frame it, fill it, finish it
  - Stents...?
Coiling vs. Clipping (pros)

- Coiling
  - Less invasive
  - Successful (95%) filling 80-90% of the time
  - Shorter hospital stay
  - Less expensive
  - Less disability

- Clipping
  - When Successful = permanent
  - Recurrence is 1.5%

Coiling vs. Clipping (cons)

- Coiling
  - Rupture in 1.4-2.7%
  - Arterial Dissection 1%
  - Compaction
  - Coil Dislodgement

- Clipping
  - Risk of infection
  - Clipping of a neighbor vessel
  - Brain tissue damage

Recommendation is still Clipping if you have a surgeon that performs >30 per year.

After definitive treatment, all care focuses on complication prevention and symptom management.

Initial Resuscitation

- Supplemental oxygen for brain protection
- Immediate ventilatory support if needed
- Liberal isotonic fluids to enhance circulation
- Specific attention to blood pressure acutely and ongoing
  - <140 mmHg before securing
  - 140-160 mmHg post securing
  - Let BP ride when in VSP; augment if needed
- Initial neurologic assessment: baseline determines treatment, outcome

Nursing Measures

- Astute observation for early changes
- Understanding of individual risks, time frames, interventions
- Most advocate quiet nonstressful environment with complete care; no nursing evidence to support this
- Research is needed on factors that positively or negatively affect care and outcome, such as position, activity, effects of sedation
Neurologic Assessment

- Frequency: dictated by situation, institution
- Focus on anatomy
- Tools used: GCS, NIHSS
  - GCS does not necessarily reflect changes even with symptomatic VSP (best score) use modified
  - NIHSS: accurate but time consuming
  - Abbreviated form recommended
- Research suggests that certain patient behaviors may be indicative of early VSP

Helpful Assessment Hints

- PCOMM: Third Nerve Palsy
- ACOMM: Bilateral Lower extremity weakness (think HAL)
- MCA: Combination of Hemi-paresis and visuospatial neglect.
- Increased ICP: 6th Nerve Palsy

Vasospasm

- Clinical (HA or change in mental status) or radiographic narrowing of cerebral vessels
- Degree of VSP related to extent of blood
- Not always "symptomatic"
- Occurs in 46% of SAH patients from days 3-21 (peak days 7-11)
- Has major impact on outcome
  - Half of those with VSP develop persistent deficits due to ischemia

Vasospasm (cont.)

- Prevention
  - Hydration: at least 3L/day
  - Nimodipine 60 mg Q 4 hrs for 21 days
  - Endothelin receptor antagonists
  - Widen BP parameters at high risk times
  - Keep magnesium WNL
- Monitoring
  - TCDs, clinical signs (headache, confusion)
  - Velocity >120 cm/s in a major vessel equals vasospasm
  - Lymphocytes, inflammatory markers

Vasospasm (cont.)

- Treatment
  - Hypervolemia/hemodilution
    - Isotonic fluids, albumin
    - Blood replacement if necessary
    - Goal Hct 30
    - Watch for CHF
  - Induced hypertension
    - Dopamine, dobutamine, neosynephrine
  - Angioplasty, intra-arterial nicardipine, verapamil
  - Consider hemicraniectomy if severe

Vasospasm (cont.)
Long-term VSP Management

- Rarely, VSP can recur or can occur as a delayed problem
- Avoid resumption of BP meds for 30 days
- Use of nimodipine after discharge?
- On discharge, make sure patients know to stay well hydrated

Hydrocephalus

- Occurs in 20% of the patients
- Can occur:
  - acutely with intraventricular blood or
  - chronically due to blockage of arachnoid villi by blood
- Can occur immediately to months later
- Relieved temporarily by ventricular or lumbar drain
- Prophylactic use may be harmful- controversial
- May require shunt later- often “slip” backward or cognitively plateau

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Intraventricular t-PA

- External ventricular drain (EVD)
- How does an EVD work?
Nursing Measures
- Monitor ICP if catheter is in place, particularly when clamped
- Compare ICP values to clinical picture
- Watch for subtle neurologic changes
- Measures to prevent infection
- If shunted - patient education

Hyponatremia
- Causes in 10-40% of SAH patients
- Incidence increases with SAH grade, hydrocephalus
- Causes fever, headache, nausea/vomiting, confusion, decreased LOC, seizures
- Physiology controversial - cerebral salt wasting (due to release of natriuretic peptide)
  vs. SIADH
- Important to know the difference as treatment differs dramatically

Hyponatremia

CSW
- Decreased ECF
- Increased Hct
- Increased albumin
- Normal/increased K
- Increased BUN
- Signs of dehydration
- CVP<6, PCWP<8
- Increased serum osmo

SIADH
- Increased ECF
- Normal Hct
- Normal albumin
- Normal K
- Increased BUN
- Signs of hypervolemia
- Increased CVP, PCWP
- Decreased serum osmo

Treatment
- If CSW - fluid and salt replacement
  - NS and salt tabs, or 3% saline
- If SIADH - fluid restriction
  - NS or 3% saline with diuretics
- Must be corrected slowly to avoid CPM
  - No greater than 10mEq/24 hours
- Frequent serum sodium checks (can change rapidly)
- Assessment of volume status mandatory
- Duration of chronic treatment unknown

Cardiac Abnormalities
- Occur in at least 27% of SAH patients
- Peak occurrence within 72 hrs.
- QT prolongation (potentially lethal), peaked T waves, ST depression
- Related to sympathetic discharge
  - can cause myocardial ischemia/infarction
- Must monitor ECG closely for changes
  - Keep potassium WNL
  - ECG changes limit treatment of VSP

Hyperglycemia
- Common response to critical illness, even if not diabetic
- Can exacerbate extent of ischemic deficit
- Need to keep tight control on glucose, before and during peak VSP time
- May require insulin drip
Seizures

- Incidence 3-26% after SAH
- Most seizures occur around the ictus
- AEDs carry risk (at least 7-10%)
- Prophylaxis not recommended unless
  - Associated intraparenchymal clot
  - Seizures noted beyond the ictus
- Unexplained decrease in consciousness may be due to subclinical seizures

Seizures (cont.)

- AEDs of choice: phenytoin, fosphenytoin
- Adverse effects can occur with medications
  - Watch for cardiac response if loading
  - Subacute allergy common
- No evidence to support use of AEDs after 30 days
  - Withdraw and monitor

Preventing Other Complications

- DVT prophylaxis with SCDs and SQ heparin
  - Occurrence can delay recovery, place patient at risk for bleeding complications
- Infection prophylaxis- use of aseptic technique, esp. with ventricular catheter
  - Usual infections are UTI, URI, ventriculitis
- Studies support oral care as prophylactic
  - Nutritional support to enhance immune function
- GI protection- use of H2 antagonist or PPI

Pain Management

- Severe headache is common in SAH during initial stages
  - AHCPR guidelines direct management
  - Pain research supports assessment in this population and aggressive pain management (morphine) to enhance physiologic stability (critical at time of VSP)
  - Medications may interfere with neurologic assessment (but so will pain), morphine reverses easily
  - Patients may exhibit pain behaviors rather than voice pain complaints
- Non-pharmacologic interventions for pain have not been studied in this population
- Chronic headache may occur, back pain is common and many patients have HA history
  - Often difficult to control if present >3 mos.
  - May be more common with coiling, skull base location

Other Issues

- Cognitive sequelae
  - More common with hydrocephalus, bilateral surgeries, prolonged unconsciousness
- Lifestyle alterations
  - Smoking cessation
  - No illicit drug use
  - Control other factors