Update in Diagnosis and Management of Intracranial Aneurysms for Primary Health Care Providers

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Boston, Massachusetts

Educational Partner:

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Session 1: Update in Diagnosis and Management of Intracranial Aneurysms for Primary Health Care Providers

Learning Objectives
1. Recognize signs and symptoms of aneurysm rupture to make appropriate diagnosis and referral.
2. Order appropriate imaging to assess for possible aneurysm.
3. Utilize knowledge regarding treatment options to make referrals and provide counsel and followup.
4. Educate the patient about the risk factors for aneurysm formation and rupture, particularly smoking.
5. For patients with a history of familial occurrence of cerebral aneurysms, perform screening tests such as MRA at the appropriate screening age.

Faculty

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Faculty Financial Disclosure Statement
The presenting faculty reports the following:
Carlos David, MD, is a consultant for and receives monetary compensation from Codman. He is a private shareholder and has stock with Surpass Medical LTD.

Education Partner Financial Disclosure Statement
The content collaborators at The Brain Aneurysm Foundation report the following:
Kathleen Redelman, NP, has no financial relationships to disclose.
Deidre A. Buckley, NP, has no financial relationships to disclose.

Suggested Reading List


Cerebral Aneurysms
Diagnosis and Management for Primary Health Care Providers

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Disclosures

Consultant Codman Neurovascular

Pre-ARS 1

Cerebral Aneurysms affect what percentage of the population?

A. 1%
B. 5%
C. 25%
D. 40%

Pre-ARS 2

Aneurysms are congenital and you are born with them?

A. True
B. False
Pre-ARS 3

Evaluation of the patient complaining of a sudden severe headache includes:

A. CT of the Brain
B. Lumbar Puncture if CT is negative
C. Analgesics for 24 hours prior to ordering CT or Lumbar Puncture
D. Both A and B
E. None of the above

Pre-ARS 4

Factors contributing to aneurysm growth and rupture include which of the following:

A. Smoking
B. Controlled Hypertension
C. Diabetes
D. Stress
E. All of the Above

Pre-ARS 5

Every family member of a patient with a confirmed cerebral aneurysm should undergo a screening MRA?

A. True
B. False

What is an Aneurysm?

- Saccular (Berry)
- Fusiform Atherosclerotic
- Mycotic
- Traumatic
Why do Aneurysms Develop?

- **Congenital Factors**
  - Medial defects
  - Elastic defects
  - Branch points

- **Acquired Factors**
  - Thinning of media
  - Degenerative changes
  - Atherosclerosis
  - Hypertension
  - Smoking

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Epidemiology

- 10-15 million Americans harbor aneurysms
- Incidence of 2-5% of population
- 50,000 people per year suffer SAH
- Approximately 50% mortality
- <40% return to functional life
- Mean age at hemorrhage ~ 50 years

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The role of Smoking

- Smokers with Aneurysms
  - Higher rate of growth
  - 3.5 fold more likely to have noted growth of > 3mm when compared to non-smokers
  - 6 fold increase in risk of SAH
  - Correlation with Smoking amount:
    - < 20 cigarettes, 3.3 times the risk
    - > 20 cigarettes 5.4 times the risk
  - Smoking likely a major contributor in aneurysm formation
  - 70-80% of patients harboring aneurysms were former or current smokers

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What about Family History?

- Familial Aneurysms
  - defined as two or more blood relatives who harbor intracranial aneurysms
  - more likely to be multiple
  - more likely to rupture at a smaller size
  - 2.5 x the risk for SAH
  - MRA Screening Recommended in all family members
  - Smoking also a major factor
  - smokers with a positive family history (1 first degree relative) have 6.4 times the risk of SAH compared to non-smokers
Familial History Screening Recommendations

- Recommended Screening MRA for age >20
- Follow up MRA every 5-10 years
- Suspicious lesion is followed up with CTA or DSA

Where do they Occur?

- Major branch Point
- Along the curve of a vessel
- Project in original direction of blood flow

Common Locations:
- Carotid Artery
- Posterior Communicating Artery (PCOM)
- Ophthalmic Artery
- Middle Cerebral (MCA)
- Anterior Cerebral (ACA)
- Basilar Tip
- Posterior Inferior Cerebellar Artery (PICA)

Classification

- Ruptured versus Un-ruptured
- Size
  - Small < 10mm
  - Large 10-25mm
  - Giant >25mm
- Complexity increases with Size

Symptoms of the Ruptured Aneurysm

- Sudden onset headache
  - “...the worst headache of my life”
- Loss of consciousness, vomiting, rigid neck
- Sentinel Bleed
- 25-50% will have history of warning leak
- Sudden headache days to weeks prior to massive bleed
- Sudden Death
What about Unruptured Aneurysms?

- Asymptomatic
- Headache/ Retro-orbital Pain
- Cranial Nerve Palsy- Pupillary Oculomotor Palsy
- Mass Effect
- Hemiparesis
- Seizure
- TIA/Stroke

Diagnostic Testing: What should a primary caregiver do?

- Symptoms suggestive of a Subarachnoid Hemorrhage
- MANDATE:
  - CT and CT Angiography if available
  - Lumbar Puncture if CT is Negative
- Other Testing
  - Magnetic Resonance Angiography
  - Digital Subtraction Angiography

Common Scenarios:

- Sudden onset “thunderclap” headache
- Sudden neck Pain progressing to headache
- Coital Headache
- “pop” in my head with minor headache
- Sudden Retro-orbital pain
- Photophobia with Headache
- Double vision and/or drooping eyelid ± pain

Other Primary Care Considerations

- Suspected Subarachnoid Hemorrhage
- Transfer to Comprehensive facility which treats > 35 Ruptured Aneurysm annually
- AHA Recommendation
- Confirmed Un-ruptured Aneurysm
- Consult Neurovascular Specialist ASAP
- Oculomotor Palsy with Aneurysm is an EMERGENCY

So Why is a Ruptured Aneurysm so bad??

- Catastrophic assault on the Central Nervous System
- Variable combination of central nervous system alterations:
  - Acute Intracranial Pressure elevations
  - Cerebral Blood Flow changes
  - Global Cerebral Ischemia
  - Catecholamine surge
  - Systemic effects

So What's Happening in the Head?

- Intracranial Pressure (ICP) and Cerebro-blood Flow (CBF) Changes
  - Massive Elevation in ICP ≥ 90 mmHg overcome Mean Arterial Pressure (MAP)
  - CBF = MAP - ICP
  - Temporary Circulatory arrest in basal vessels
  - Global Ischemia
  - Tamponade
  - Catecholamine Surge
  - Systemic and Neurologic effects
    - Pulmonary/Cardiac
    - Cerebral edema
    - Seizures/Hydrocephalus

Importance of Early Transfer

- 25% Delayed or Missed Diagnosis
- Fourfold increase in 1 year Mortality
- Re-bleeding issues
- Hydrocephalus
- Treatment of Vasospasm

Re-bleeding

- 74% Mortality in rebleed patients
- 26% overall mortality
- 4.1% rebleed rate on day 0
- Decreases to 1.5% per day
- 27% have rebleed by two weeks

Aneurysmal Subarachnoid Hemorrhage: Report of the Cooperative Study
Louis R. Caplan, MD
JAMA. 1981;246(22):2633
Hydrocephalus and Increased ICP

- Hydrocephalus due to blood blocking CSF Pathways
- Increasing Headache
- Somnolence/Confusion
- Hypertension/Bradycardia
- Requires emergent CSF Drainage

Vasospasm

- Major cause of deterioration in postoperative period
- Symptomatic in 20-30%
- Occurs 4-14 days after SAH
- Maximal on days 7-10
- Risk correlates with amount of blood in basal cisterns and fissures

Treatment of Vasospasm

- Dysautoregulation
- Enhance CBF to ischemic areas
- Hypervolemic Hemodilution Hypertension
- Intra-arterial Papavarine
- Angioplasty

Cardiac Complications

- Acute period <48h
- Catecholamine Surge
- Arrhythmias
- Ventricular Tach
- QT changes
- ST Wave changes
- MI (1-5% of cases)
- Sub-endocardial Ischemia
  - 12% of fatal SAH
Pulmonary Issues

- Common 20-25%
- Pneumonia, atelectasis
- Neurogenic Pulmonary Edema
  - Catecholamine surge
  - Poor grade
  - Transient
  - Intubation, Peep
  - Furosemide, Morphine

Treatment Overview
The ruptured aneurysm

- Strategy is to minimize risk of re-bleeding and allow aggressive treatment of vasospasm
- Secure aneurysm as soon as possible
- Requires rapid referral to high volume center
- Window of treatment
  - Days 0-4
  - Days >14
- Surgical Clipping
- Endovascular Therapy

The Un-ruptured Aneurysm

What to do with the incidental finding of a small aneurysm?

Unruptured intracranial aneurysms: natural history, clinical outcome, and risks of surgical and endovascular treatment
Lancet. 2003 Jul 12;362(9378):103-10

- 4560 patients were assessed: 1692 did not have aneurysmal repair, 1917 had open surgery, and 451 had endovascular procedures. 

<table>
<thead>
<tr>
<th>Size</th>
<th>Anterior Circumflex Aneurysm</th>
<th>Posterior Circumflex Aneurysm</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;7mm</td>
<td>0%</td>
<td>2.5%</td>
</tr>
<tr>
<td>7-12mm</td>
<td>2.6%</td>
<td>14.5%</td>
</tr>
<tr>
<td>13-24mm</td>
<td>14.5%</td>
<td>18.4%</td>
</tr>
<tr>
<td>&gt;25mm</td>
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</tr>
</tbody>
</table>
Symptomatic aneurysms of all sizes should be treated (CN Symp, Retro-orbital HA, Mass Effect).

Asymptomatic aneurysms greater than 7mm should be treated.

Vertebro-basilar and PCOMM aneurysms should be treated regardless of size.

Co-existing aneurysms in patients with previous SAH should be treated regardless of size.

Aneurysms less than 7mm in patients without previous SAH can be observed.

Special consideration for treatment:
- Young patients
- Aneurysm approaching 7mm size
- Aneurysm morphology: “daughter sacs”
- Family History
- Smokers


Treatment Options

Endovascular
- Less invasive
- Shorter LOS
- 8% risk
- Morphological outcome
  - Complete (54%)
  - Near complete (19%)<br>  - 90% occlusion (20%)
  - <90% occlusion (13%)
- Recanalization rate significant (20-57%) requiring continued follow-up imaging

Surgery
- Open craniotomy
- Longer length of stay
- 7-12% risk
- Risk dependent on location, age, overall medical condition
- More likely to result in complete obliteration
- Recurrence after complete clipping <1%

Follow-up imaging

Endovascular Therapy
- Balloon-Assisted Aneurysm Coiling
- Stent-Assisted Aneurysm Coiling
- 3 Dimensional Coils
- Bio-Active Coils
- Onyx

Management Considerations: Clipping versus Coiling

Anatomy and Location
- Middle Cerebral Artery, Post Communicating (OPEN)
- Basilar Bifurcation, Ophthalmic, Cavernous (Endovascular)
- Wide Neck, H:N ratio

Age, Co-morbidities

Goals
Risks of Treatment

- Stroke
- Hemorrhage
- Seizures
- Infection
- Neurological Deficit
- Death

Surgical Obliteration
The ooh and ahh part of the talk

Saturday, November 10, 12

When Things can’t be clipped or coiled...

Saturday, November 10, 12

Take Home Points

- Any SUDDEN onset Headache needs immediate evaluation!
  - CT and LP
- New pupil-involved 3rd Nerve palsy requires immediate CTA or MRA!
- Screening MRA for family history, connective tissue disorder, PCKD, Coarctation.
- Risk Modification: Smoking Cessation, Control Hypertension
- Incidental Aneurysms
  - Anterior Circulation (ophthalmic, Middle Cerebral Artery, Anterior Communicating) less than 7mm have low risk of rupture
- However, consider shape and morphology, Family History, Smoking, Hypertension
  - Posterior Communicating, Posterior Circulation and ALL aneurysm >7mm should be considered for treatment
- Early Neurosurgical Consultation

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