Small Aneurysms: Determining When to Treat

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Disclosures

• No financial interest in any product or manufacturer mentioned herein.
Important questions

- Do small aneurysms rupture?
- Risk factors for rupture?
- Can small aneurysms be treated with acceptable risk?
Talk aims

- Define small aneurysms
- Review historical perspectives and trends in management
- Discuss rupture rates
- Present risk factors
- Describe treatment feasibility and safety
3 mm
5 mm
What is a “Small Aneurysm”?  

- Size is somewhat arbitrarily assigned by investigators to stratify data.
- Inconsistently defined in the literature.
- Overall, defined as <10 mm in maximum diameter.
- Reports range from 5 to 11 mm in max diameter.
- “Very small” are often < 3 mm in max diameter.
Historical perspective

- What has influenced current trends?
- Guidelines?
- Landmark studies that have shaped perspective?
Japan Neurosurgical Society, 1996

- Japan Neurosurgical Society conducted a survey in 1996
- 87% of centers in Japan agreed that incidentally discovered unruptured aneurysms < 5 mm in diameter should be followed without treatment
Recommendations for the Management of Patients with Unruptured Intracranial Aneurysms

“In consideration of the apparent low risk of hemorrhage from incidental small (<10 mm) aneurysms in patients without previous SAH, treatment rather than observation cannot be generally advocated. However, special considerations for treatment…”

Circulation. 2000;102:2300
Guglielmi detachable coils, 1997

- UCLA group published early GDC experience in ruptured intracranial aneurysms
- FDA approved study of GDC system in ruptured aneurysms; 8 centers, 403 patients; 1990-95.
- 61% were small aneurysms (4-10 mm)
- 9/11 aneurysm perforations occurred in small aneurysms
- Perforation precipitated death in 6 patients

Vinuela F et al. J Neurosurg 1997;87:475
Small aneurysms can rupture

1983, Kassell NF et al.
- 13% of aneurysms were less than 5 mm in diameter

2002, ISAT (International Subarachnoid Aneurysm Trial)
- The majority of aneurysms (92%) were small, < 11 mm
- About half of the small aneurysms were ≤ 5 mm

ISAT Lancet 2002; 360:1267
Small aneurysm rupture rates

- What do prospective studies tell us about small aneurysm rupture rates?
Prospective Unruptured aneurysm trials

- Helsinki (Juvela, 2000)
  - 181 patients
  - 20 year median follow up
  - Overall annual rupture rate 1.3%

- ISUIA (2003)
  - 5-year cumulative risk of rupture of anterior circulation aneurysms <7 mm was 0%

Juvela S et al. 2008;108:1052
ISUIA Lancet 2003;362:103
Prospective Unruptured aneurysm trials

- SUAVe Study (2010)
  - Japan
  - Unruptured aneurysms < 5 mm
  - 448 aneurysms followed for 41 months
  - Annual rupture rate = 0.54%

- UCAS Japan (2012)
  - 6697 aneurysms
  - Inclusion criteria: 3 mm or larger
  - Overall annual rupture rate 0.95%
  - Size 7 mm or larger had significantly increased risk of rupture

Sonobe M et al. Stroke. 2010;41:1969
UCAS NEJM 2012;366:2474
Prospective natural history data suggest low rupture rates for small aneurysms. Procedural risk may be higher in treatment of small aneurysms. Specifically regarding perforation, it supports a conservative position. Yet, a substantial proportion of aneurysms in ruptured series are small.
Increasing treatment

- Despite the low rupture rates for incidentally identified aneurysms suggested by reports, treatment has been increasing.
- Between 1997 - 2006
- 75% increase in hospitalizations associated with unruptured aneurysms

(Nationwide Inpatient Sample)

Can we identify risk factors to better select patients?
Risk factors for aneurysm rupture

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</thead>
<tbody>
<tr>
<td><strong>SIZE</strong></td>
<td>All</td>
<td>All</td>
<td>All</td>
<td>&lt; 5 mm</td>
<td>&lt; 7 mm</td>
<td>&lt; 5 mm</td>
<td>&lt; 7 mm</td>
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<tr>
<td><strong>N</strong></td>
<td>1692</td>
<td>6,697</td>
<td>181</td>
<td>448</td>
<td>100</td>
<td>854</td>
<td>384</td>
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<tr>
<td><strong>Years</strong></td>
<td>3 years</td>
<td>20 yr median</td>
<td>3 years</td>
<td>Retrospective</td>
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<td>4 years</td>
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<tr>
<td><strong>Size</strong></td>
<td>Size &gt; 7 mm</td>
<td>Larger size</td>
<td>Size &gt;/= 4 mm</td>
<td>Younger age</td>
<td>Larger size</td>
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<tr>
<td><strong>Location</strong></td>
<td>Acom, Pcom location</td>
<td>Age</td>
<td>Age &lt; 50</td>
<td>Posterior location</td>
<td>Size ratio</td>
<td>Age &lt; 50</td>
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<tr>
<td><strong>Prior SAH</strong></td>
<td>Daughter sac</td>
<td>Smoking</td>
<td>HTN</td>
<td>HTN</td>
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<td><strong>Multiplicity</strong></td>
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Are treatment risks in small aneurysms known?
Small aneurysm treatment risk

Oishi H et al. AJNR 2012
- Endovascular treatment of 500 small UIAs
  - < 10 mm
  - Complications 7.6%
  - Permanent morbidity and mortality, 0.8% and 0.2%.
  - Retreatment required in 10%
  - No SAH in 35 month follow up

Loumiotis I et al. JNS 2011
- Endovascular and surgical tx of 82 patients
  - <10 mm
  - Morbidity and mortality, 1.5% and 1.5%.

Oishi H et al. AJNR 2012;33:958
Loumiotis I et al. JNS 2011;31:E4
Treatment risk in “very small” aneurysms

Brinjikji et al 2010

- Meta-analysis
- Endovascular treatment of “Very Small” aneurysms, 3 mm or smaller
- Feasible and effective in >90%
- Higher periprocedural risk than in larger aneurysms
  - 7.3% periprocedural morbidity and mortality
  - Intraprocedure rupture rate
  - Ruptured aneurysms: 10.7 %
  - Unruptured aneurysms: 5 %
Size perspective

<1% annual rupture risk
< 7 mm

>1% annual rupture risk
7-20 mm

10 – 20% annual rupture risk
> 20 mm
Size perspective

- < 1% annual rupture risk
  - < 7 mm
  - > 1% annual rupture risk
  - 7-20 mm
  - 10 – 20% annual rupture risk
  - > 20 mm

Likely offer Treatment
Small UIA management

< 1% annual rupture risk

< 7 mm

Likely requires individualized management considering risk factors/decision modifiers

<table>
<thead>
<tr>
<th>Decision modifiers</th>
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<tr>
<td>Size</td>
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<tr>
<td>Morphology</td>
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<tr>
<td>Location</td>
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<td>Young age</td>
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<td>Smoking</td>
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<td>Excessive alcohol use</td>
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<tr>
<td>HTN</td>
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<tr>
<td>H/o SAH</td>
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<td>Female sex</td>
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<td>Family history</td>
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<td>Psychological stress</td>
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<td>Comorbidities and life expectancy</td>
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Small UIA management

0 – 1% annual rupture risk

< 7 mm

≤3 mm

Observation.
Requires compelling reason for treatment
• Multiple decision modifiers needed
• Favorable anatomy for treatment

3-7 mm

Observation versus treatment, individualized management with decision modifiers
2.5 mm  Conical shape, HTN, Smoking, female
5 mm  Irregular, HTN, Smoking
3 mm  Daughter sac, HTN, Smoking, H/o prior SAH
5 mm  Bilobed, HTN, Smoking
6 mm, 2 mm  Bilobed, HTN, female
Summary

- Small aneurysms are not benign
- Small aneurysm treatment is feasible
- Safety and efficacy likely to increase with techniques and technology
- Size is only the starting point of decision making
- Decreasing aneurysm size requires increasingly careful consideration of decision modifiers