Renal and Mesenteric Aneurysms

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No Conflicts
Renal Artery Aneurysms

- Estimated incidence: 1/10,000 (0.09%)
  - Increasing with use of abdominal CT/CTA and MRI/MRA
- Relatively unknown natural history
  - Rupture < 3%
    - Unknown growth rate
    - Disputed association between size and risk of rupture
    - Genetics not evaluated


Current Treatment Recommendations

- “Symptomatic” aneurysms
  - Abdominal/flank pain
  - Hematuria
  - Poorly controlled hypertension
- “Asymptomatic”
  - ≥ 2 cm
  - Pregnant women/Child-bearing age
  - Rapidly enlarging
**RAA-Largest Experience**

Renal Artery Aneurysms
A 35-Year Clinical Experience With 252 Aneurysms in 168 Patients
Peter K. Henke, MD, Jethro D. Gardshau, MD, Theodore H. Weliky, MD, Gilbert L. Lipschutz, Jr., MD,
Thomas W. Nekelstedt, MD, Lloyd A. Jacobs, MD, Shannon B. Pootor, Lazar J. Greenfield, MD, and James C. Stanley, MD
From the Department of Surgery, Section of Vascular Surgery, University of Michigan, Ann Arbor, Michigan

- No significant difference in size
  - Surgical: 1.5 cm
  - Observation: 1.3 cm
- No change in BP (surgical patients)


“Most aneurysms 1.5-2 cm, and all > 2 cm, regardless of BP status, should be surgically treated”

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**RAA-Size Doesn’t Matter**

Renal artery aneurysm: Selective treatment for hypertension and prevention of rupture
Raymond S. Martin III, MD, Patrick W. Meacham, MD, Jeff A. Ditesheim, MD,
Joseph L. Mulherin, Jr., MD, and William H. Edwards, MD, Nashville, Tenn.

- Rupture: 1 cm aneurysm
- BP improved: 13/17 (76%)
- No acute complications (observation pts)
- 0% mortality


“Size alone should be an uncommon indication for resection of an RAA”
The Contemporary Guidelines for Asymptomatic Renal Artery Aneurysms Are Too Aggressive: A North American Experience

On behalf of the Vascular Low-Frequency Disease Consortium:

Dawn M. Coleman, MD; Peter F. Lawrence, MD; Jill Q. Klausner, BS; Michael P. Harlander-Locke, MPH; James C. Stanley, MD; Audra Duncan, MD; Gustavo S. Oderich, MD; Adnan Z. Rizvi, MD; Tazo S. Inui, MD; Robert J. Hye, MD; Matthew W. Meller, MD; Naoki Fujimura, MD/PhD; Nathan K. Itoha, MD; Misty Humphries, MD; Jacob Loeftier, BS; Paul G. Bove, MD; Christopher J. Abularrage, MD; Robert J. Feezor, MD; Amir F. Azarbal, MD; Matthew R. Smeds, MD; Joseph S. Ladowski, MD; York N. Hsiang, MD; Vivian M. Leung; Josefina A. Dominguez, MD; Fred A. Weaver, MD; Mark D. Morasch, MD
Question #1

1. The most common reason that patients have renal artery aneurysms discovered is:
   a. Severe hypertension workup
   b. Incidental finding on screening CTA or MRA
   c. Back pain evaluation
   d. Cross-sectional imaging without symptoms
   e. Family history of aneurysms
Clinical Presentation  
(651 Patients, 759 RAA)

<table>
<thead>
<tr>
<th>Presenting Symptoms</th>
<th>N</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymptomatic</td>
<td>547</td>
<td>71%</td>
</tr>
<tr>
<td>Hypertension – Difficult to Control</td>
<td>87</td>
<td>12%</td>
</tr>
<tr>
<td>Flank Pain</td>
<td>55</td>
<td>8%</td>
</tr>
<tr>
<td>Hematuria</td>
<td>30</td>
<td>4%</td>
</tr>
<tr>
<td>Abdominal Pain</td>
<td>29</td>
<td>4%</td>
</tr>
<tr>
<td>Other (Back Pain, etc.)</td>
<td>12</td>
<td>1%</td>
</tr>
</tbody>
</table>

2. From the anatomic perspective, renal artery aneurysms are:
   a. More common on the left than the right
   b. Usually fusiform
   c. Usually multiple
   d. Most often located at the renal bifurcation
   e. Non-calcified
2. From the anatomic perspective, renal artery aneurysms are:
   a. More common on the left than the right
   b. Usually fusiform
   c. Usually multiple
   d. Most often located at the renal artery bifurcation
   e. Non-calcified
### Morphology - Associated with Fibromuscular Dysplasia

#### Aneurysm Characteristics

<table>
<thead>
<tr>
<th>Aneurysm Characteristics</th>
<th>N (% of Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Morphology</strong></td>
<td></td>
</tr>
<tr>
<td>Saccular</td>
<td>650 (86%)</td>
</tr>
<tr>
<td>Fusiform</td>
<td>83 (11%)</td>
</tr>
<tr>
<td>Bi-lobed</td>
<td>26 (3%)</td>
</tr>
<tr>
<td><strong>Number of Additional Efferent Branches Originating from RAA</strong></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>136 (18%)</td>
</tr>
<tr>
<td>1</td>
<td>228 (30%)</td>
</tr>
<tr>
<td>2</td>
<td>266 (35%)</td>
</tr>
<tr>
<td>3+</td>
<td>129 (17%)</td>
</tr>
<tr>
<td><strong>Calcification</strong></td>
<td></td>
</tr>
<tr>
<td>Calcified</td>
<td>410 (54%)</td>
</tr>
<tr>
<td>Non-calcified</td>
<td>349 (46%)</td>
</tr>
<tr>
<td><strong>Mean Maximum Diameter</strong></td>
<td>16 ± .3 mm</td>
</tr>
</tbody>
</table>
Patient Management

Initial Evaluation
651 Patients, 759 RAA

Symptomatic
187 Patients, 201 RAA
Mean Diameter = 19 ± 1 mm

Asymptomatic
464 Patients, 558 RAA
Mean Diameter = 15 ± 1 mm

Elective Repair
118 Patients, 124 RAA
Mean Diameter = 24 ± 1 mm
Mean Time to Repair = 6 Mo.

Observation
373 Patients, 445 RAA
Mean Follow-Up = 54 Mo.
Mean Diameter = 13 ± 1 mm

Elective Repair
91 Patients, 113 RAA
Mean Diameter = 24 ± 1 mm
Mean Time to Repair = 6 Mo.

Observation
69 Patients, 77 RAA
Mean Follow-Up = 40 Mo.
Mean Diameter = 13 ± 1 mm

Observation
373 Patients, 445 RAA
Mean Follow-Up = 54 Mo.
Mean Diameter = 13 ± 1 mm

Initial Repair Techniques

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Number (% of Total Pts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative Repair</td>
<td>159 (23%)</td>
</tr>
<tr>
<td>Resection w/ Primary Closure</td>
<td>57 (9%)</td>
</tr>
<tr>
<td>Resection w/ Patch</td>
<td>26 (4%)</td>
</tr>
<tr>
<td>Ex-Vivo/Complex Repair</td>
<td>23 (4%)</td>
</tr>
<tr>
<td>Aneurysmectomy w/ Bypass</td>
<td>17 (3%)</td>
</tr>
<tr>
<td>Resection w/ Primary Anastomosis</td>
<td>16 (2%)</td>
</tr>
<tr>
<td>Unplanned Nephrectomy</td>
<td>6 (&lt;1%)</td>
</tr>
<tr>
<td>Planned Nephrectomy</td>
<td>4 (&lt;1%)</td>
</tr>
<tr>
<td>Endovascular Repair</td>
<td>50 (9%)</td>
</tr>
<tr>
<td>Stent Graft</td>
<td>39 (6%)</td>
</tr>
<tr>
<td>Coil Embolization</td>
<td>21 (3%)</td>
</tr>
</tbody>
</table>
Surgical Management
Resection with Patch

Sousou ID et al. Arch Surg 1979

Surgical Management
Resection with Primary Repair

Sousou ID et al. Arch Surg 1979
Surgical Management
Resection with Bypass

Soussou ID et al. Arch Surg 1979

Surgical Management
Resection with Reimplantation

Martin III RS et al. JVS 1989
Surgical Management
Ex-Vivo/Complex Repair

Gallagher KA et al. JVS 2008

Management
Endovascular Stent Graft

Gates L et al. Medscape 2013
3. When comparing treatment outcomes of open surgery and endovascular repair of RAA:
   a. Open cases have more minor and major complications
   b. The length of stay (LOS) is similar
   c. Either is appropriate for most patients
   d. Neither has a significant impact on most patient’s hypertension
   e. Most patients with RAA >3 cm present with rupture
Open vs. Endovascular Repair

<table>
<thead>
<tr>
<th></th>
<th>Open Repair</th>
<th>Endovascular Repair</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>159</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Hospital LOS</td>
<td>8</td>
<td>2</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Minor perioperative complications</td>
<td>19%</td>
<td>4%</td>
<td>.066</td>
</tr>
<tr>
<td>Major perioperative complications</td>
<td>8%</td>
<td>2%</td>
<td>.312</td>
</tr>
<tr>
<td>Late complications</td>
<td>9%</td>
<td>8%</td>
<td>.118</td>
</tr>
<tr>
<td>Deaths</td>
<td>2</td>
<td>1</td>
<td>.707</td>
</tr>
</tbody>
</table>

Uncontrollable HTN prior to operation in 127 patients
- 31 (24%) cured; 29 (23%) improved; 67 (53%) no change

RAA found specifically during workup for HTN in 78 patients
- 24 (31%) cured; 20 (25%) improved; 34 (44%) no change
Conservative Management

- Aneurysms observed for mean 45 ± 5 months
  - 373 asymptomatic patients and 69 symptomatic patients
  - 76 RAA >2 cm with mean follow up time of 23 ± 4 months, and
    none ruptured
  - 7 RAA ≥3 cm with mean follow up time of 17 ± 3 months, and
    none ruptured
- Acute complications developed in no patients
- Serial imaging performed in 78% with a mean of 8 ± 2 months between imaging studies

Growth Rate

Growth Rate Distribution

Mean = .95 ± 3 mm/year
Median = 0 mm/year
Mode = 0 mm/year

Mean Growth Rates

P = .521

All Aneurysms = 0.95 mm/year
Non-Calcified Aneurysms = 0.56 mm/year
Calcified Aneurysms = 1.03 mm/year
RAA Conclusions

- RAA < 3 cm rarely rupture, even when 2-3 cm and not calcified
- RAA growth rate is 1 mm/year, although most did not grow
  - With current threshold of > 2 cm to repair, 66% of asymptomatic RAA in this study would require surgical repair in the next 10 years
  - With a threshold of > 3 cm to repair, only 11% of asymptomatic RAA in this study would require surgical repair in the next 10 years
- Repair cured or improved hypertension in > 50% of patients whose RAA was found during workup for difficult-to-control-hypertension

Mesenteric (Splanchnic) Aneurysms

- 138 SAA
  - 82% male
  - 46% synchronous
- 85 % due to three artery aneurysms
  - Celiac 46%
  - Splenic 30%
  - SMA 9%

Erban J Vasc Surg 2017
Visceral (Splanchnic) Aneurysms

- MGH experience
- 264 SAA’s in 250 patients; 67% surveillance
  - Mean aneurysm size 16 mm (8-41 mm)
  - 6% required intervention for growth
- No ruptures in the surveillance cohort
- 88 SAA’s (33.3%) repaired; mean 31 mm
  - 30-day M&M after elective repair 13% and 3%
- 13(15%) ruptured; 30-day M&M 54% and 8%
- Five ruptured SAAs (38%) pancreaticoduodenal


Question # 4

4. The one mesenteric aneurysm that should not be routinely embolized or ligated is:
   a. Celiac
   b. Gastroduodenal
   c. Splenic
   d. Superior mesenteric
   e. Inferior mesenteric
4. The one mesenteric aneurysm that should not be routinely embolized or ligated is:
   a. Celiac
   b. Gastroduodenal
   c. Splenic
   d. Superior mesenteric ★
   e. Inferior mesenteric

MGH Splanchnic Aneurysm Distribution

= only aneurysm that can’t routinely be ligated or embolized
Splenic Artery aneurysms

- 128 patients over a 13 year period
- Age = 61; 70% women
- 62 patients Rx’ed-- 49 with endo, 13 with surgery
- 10% ruptured; 2 deaths in ruptured

Lakin et al, J Vasc Surg 2011

Coil Embolization of Splenic Artery Aneurysm
Laparoscopic Repair of Splenic Artery Aneurysm

Survival of Patients with Splenic Artery Aneurysms
Superior Mesenteric Artery
Aneurysms

- 21 patients; 2/3 men
- Many presented ruptured
- None on B-blockers ruptured
- Open repair on most in the early endo era
- Most are degenerative
- Calcification common although rupture rarely in calcified region

Spontaneous Mesenteric Dissection

12 institutions from US, France, Netherlands, and Japan

Outcomes

Asymptomatic patients (N=65)

- No late vessel thrombosis
- 6 aneurysmal degeneration (Median time 6.5 months)

Median follow up = 18 months
Outcomes of Spontaneous Mesenteric Dissection

Symptomatic patients (N=162)

- 6 late vessel thrombosis
  (Median time 2 months)

- 10 aneurysmal degeneration
  (Median time 10 months)

Conclusions

- Mesenteric and renal artery aneurysms are often silent until they rupture
- Endo and open repair are available for most aneurysms
- New data on expansion rates and rupture are reducing repair rates
- The only artery that can not be ligated or embolized routinely is the SMA