Management of Renal Artery Aneurysms

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Peter Lougheed Centre

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Disclosure: I have no relationship with commercial entities

The Society for Vascular Surgery clinical practice guidelines on the management of visceral aneurysms

Rabih A. Chaer, MD,[a] Christopher J. Abularrage, MD,[b] Dawn M. Coleman, MD,[c] Mohammad H. Eslami, MD,[a] Vikram S. Kashyap, MD,[d] Caron Rockman, MD,[e] *and* M. Hassan Murad, MD,[f] *Pittsburgh, Pa; Baltimore, Md; Ann Arbor, Mich; Cleveland, Ohio; New York, NY; and Rochester, Minn*

ABSTRACT

These Society for Vascular Surgery Clinical Practice Guidelines describe the care of patients with aneurysms of the visceral arteries. They include evidence-based size thresholds for repair of aneurysms of the renal arteries, splenic artery, celiac artery, and hepatic artery, among others. Specific open surgical and endovascular repair strategies are also discussed. They also describe specific circumstances in which aneurysms may be repaired at smaller sizes than these size thresholds, including in women of childbearing age and false aneurysms. These Guidelines offer important recommendations for the care of patients with aneurysms of the visceral arteries and long-awaited guidance for clinicians who treat these patients. (J Vasc Surg 2020;72:3S-39S.)

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SUMMARY OF RECOMMENDATIONS

Renal artery aneurysm (RAA). **1.1:** In patients who are thought to have RAAs, we recommend computed tomography angiography (CTA) as the diagnostic tool of choice. **Level of recommendation: Grade 1 (Strong), Quality of Evidence: B (Moderate).**

1.2: In patients who are thought to have RAA and have increased radiation exposure risks or renal insufficiency, we recommend non-contrast-enhanced magnetic resonance angiography (MRA) to establish the diagnosis. **Level of recommendation: Grade 1 (Strong), Quality of Evidence: C (Low).**

From the Division of Vascular Surgery, University of Pittsburgh Medical Center, Pittsburgh[a]; the Division of Vascular Surgery, Johns Hopkins Hospital, Baltimore[b]; the Division of Vascular Surgery, University of Michigan Hospitals, Ann Arbor[c]; the Division of Vascular Surgery, University Hospitals Case Medical Center, Cleveland[d]; the Division of Vascular Surgery, New York University Langone Medicine Center, New York[e]; and the Mayo Clinic Evidence-Based Practice Center, Rochester.[f]

Author conflict of interest: none.

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(J Vasc Surg 2020;72:3S-39S.)

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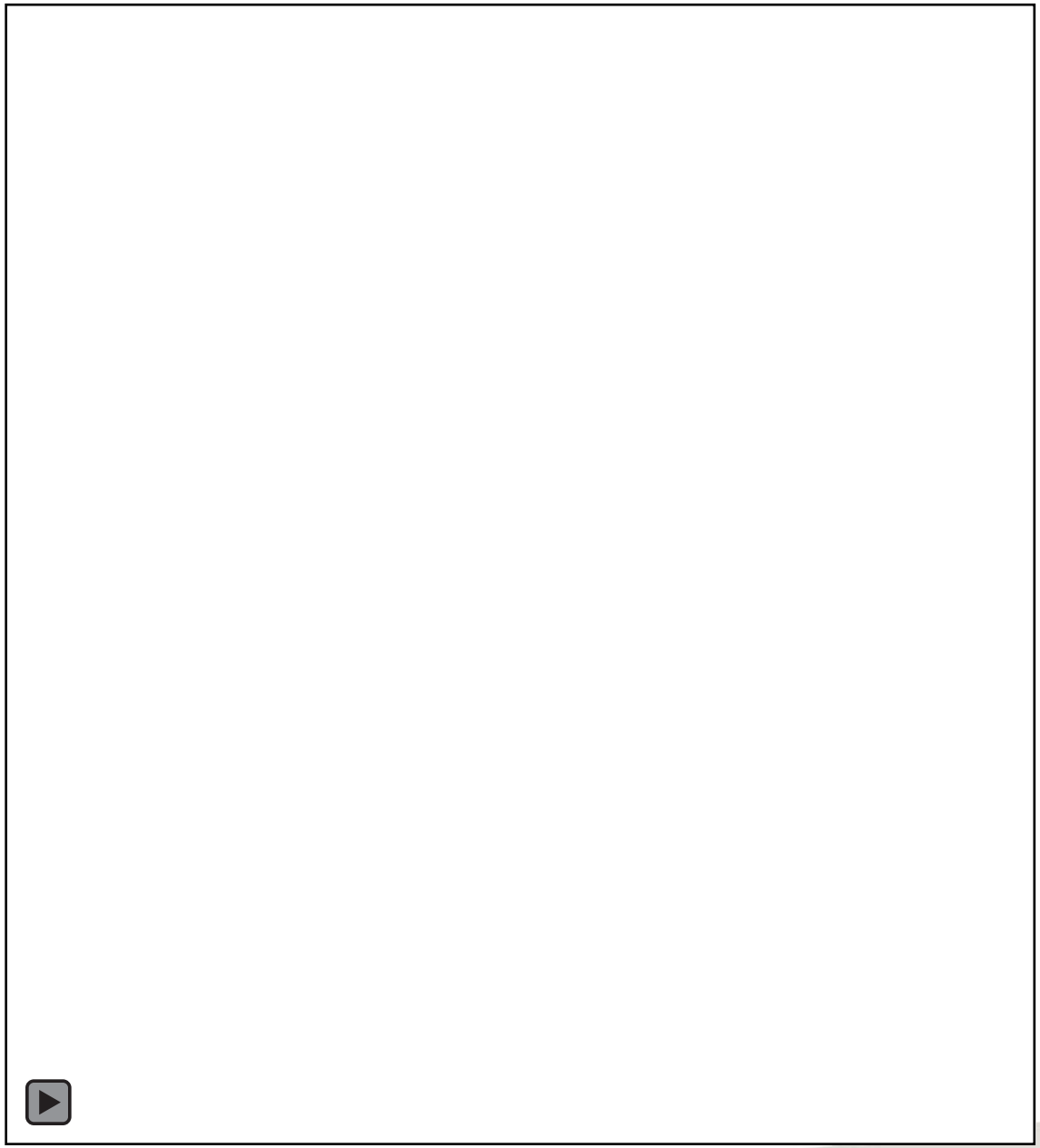
Management of Renal Artery Aneurysms:

1. *Who gets them?*
2. *When and why are they important?*
3. *When and how to treat them?*

Case 1 :

- *74 y.o. healthy female*
- *1.4 cm saccular aneurysm at hilum → stable >2 years, asymptomatic*
- *Solitary left kidney*
- *Normal GFR*
- *hypertension → single agent*



Live Poll – How will you manage this?

1. *Watch it*
2. *Treat it*
3. *Investigate further, then decide what to do*

Case 2 :

- *56 y.o. male (heavy-duty mechanic, smoker)*
- *fusiform aneurysm of distal renal artery, asymptomatic*
- *Normal GFR*
- *hypertension → 3 agents, with poor control*

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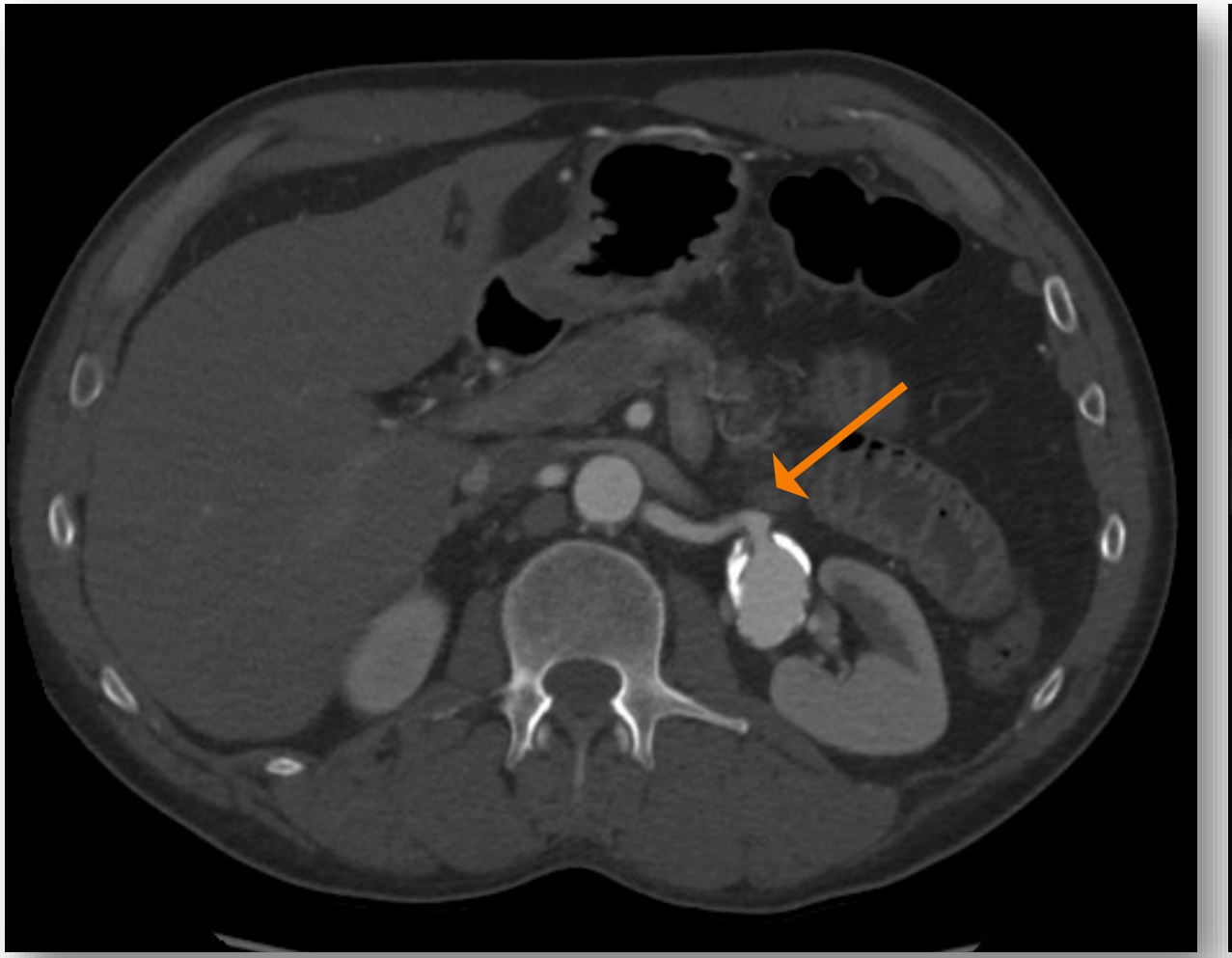

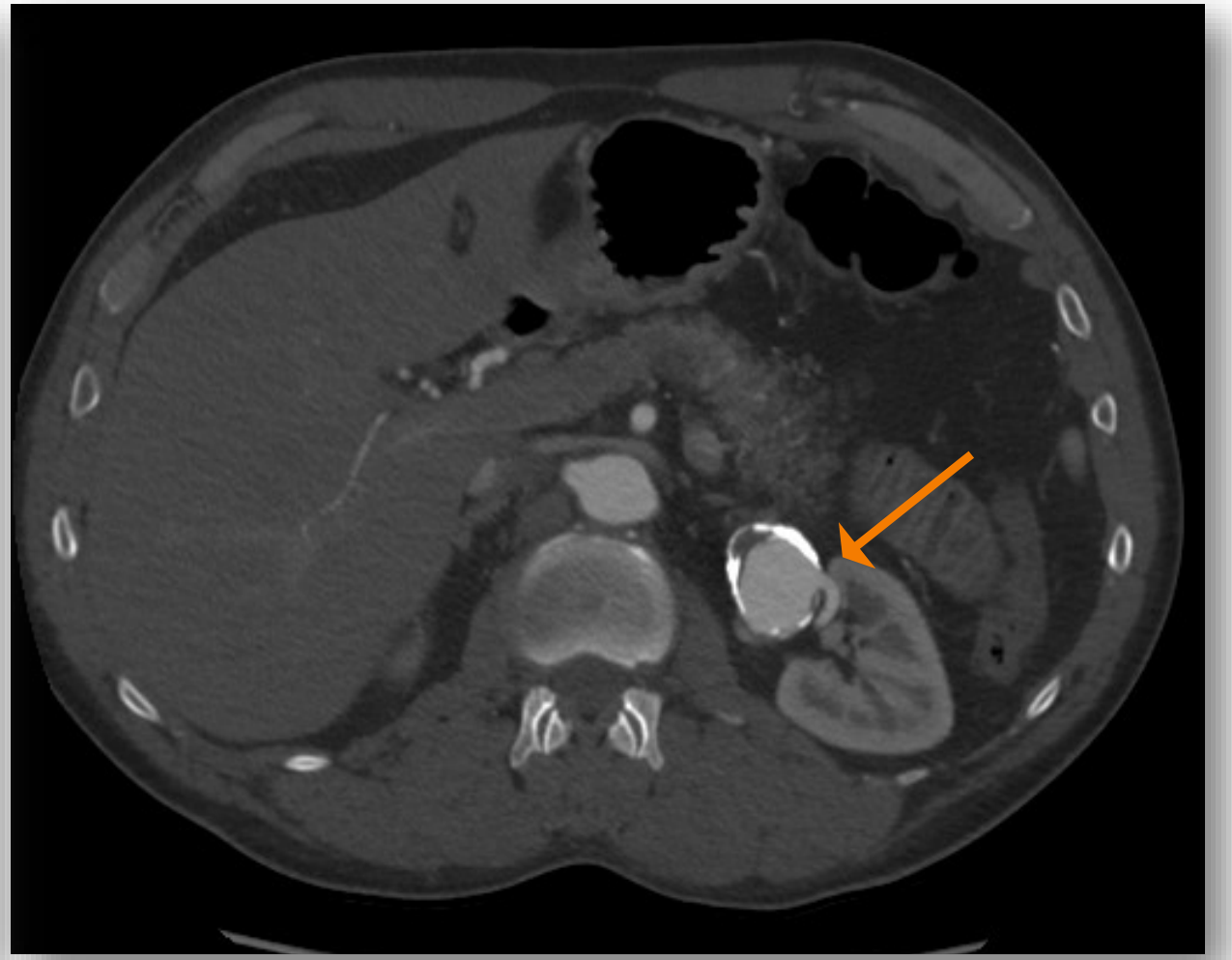

Live Poll – How will you manage this?

1. *Watch it*
2. *Treat it*
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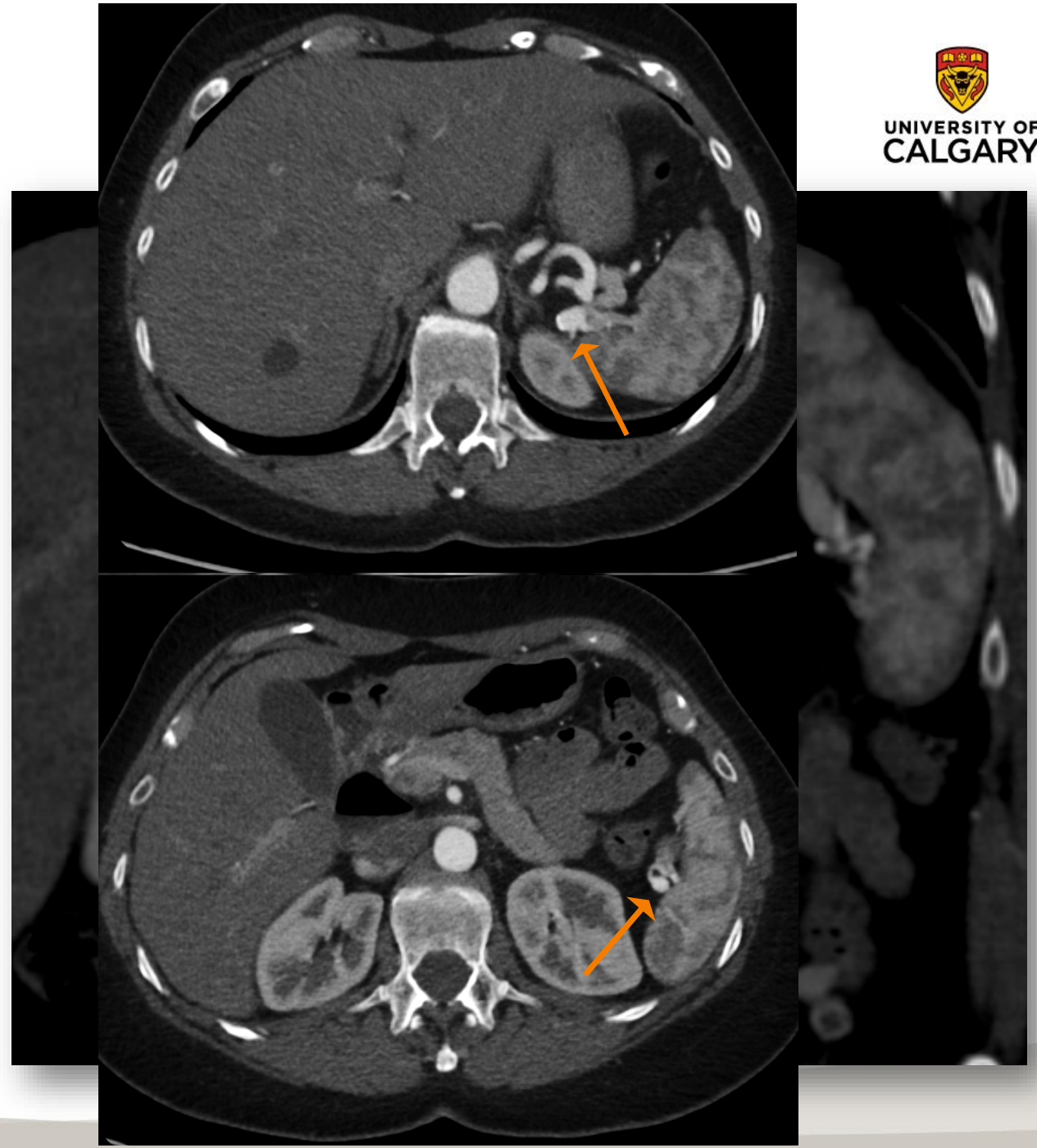
Case 3 :

- *37 y.o. healthy female*
- *1.9 cm saccular aneurysm in hilum, asymptomatic*
- *Splenic artery aneurysms, <1 cm.*



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Renal artery aneurysms

Dawn M. Coleman, MD, and James C. Stanley, MD, Ann Arbor, Mich

(J Vasc Surg 2015;62:779-85.)

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Populations at risk for renal artery aneurysm

1. Elderly
2. Smokers
3. Persons with atherosclerosis and hypertension
4. Females
5. Persons with FMD
6. Persons with visceral, carotid or cerebral aneurysms

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3. Persons with atherosclerosis and hypertension
4. Females
5. Persons with FMD
6. Persons with visceral, carotid or cerebral aneurysms

Female preponderance:

- Henke, Ann. Surg. 2001: n=168: **64% female**
- Pfeiffer, JVS 2003, n=83: **61% female**
- Klausner, JVS 2015, n=865: **58% female**
- Brownstein, JVS 2018, n=241: **61% female**
- Zhang, JVS 2023, n=231: **62% female**,
- Fargion, JVS 2023, n=126: **54% female**
- Sheahan, J Vasc Interv Radiol 2024, n=454: **62% female**

Dissection and Aneurysm in Patients With Fibromuscular Dysplasia

Findings From the U.S. Registry for FMD

Daniella Kadian-Dodov, MD,[a] Heather L. Gornik, MD, MHS,[b] Xiaokui Gu, MA,[c] James Froehlich, MD, MPH,[c] J. Michael Bacharach, MD, MPH,[d] Yung-Wei Chi, DO,[e] Bruce H. Gray, DO,[f] Michael R. Jaff, DO,[g] Esther S.H. Kim, MD, MPH,[b] Pamela Mace, RN,[h] Aditya Sharma, MBBS,[i] Eva Kline-Rogers, MS, RN, NP,[b] Christopher White, MD,[j] Jeffrey W. Olin, DO[a]

(J Am Coll Cardiol 2016;68:176–85)

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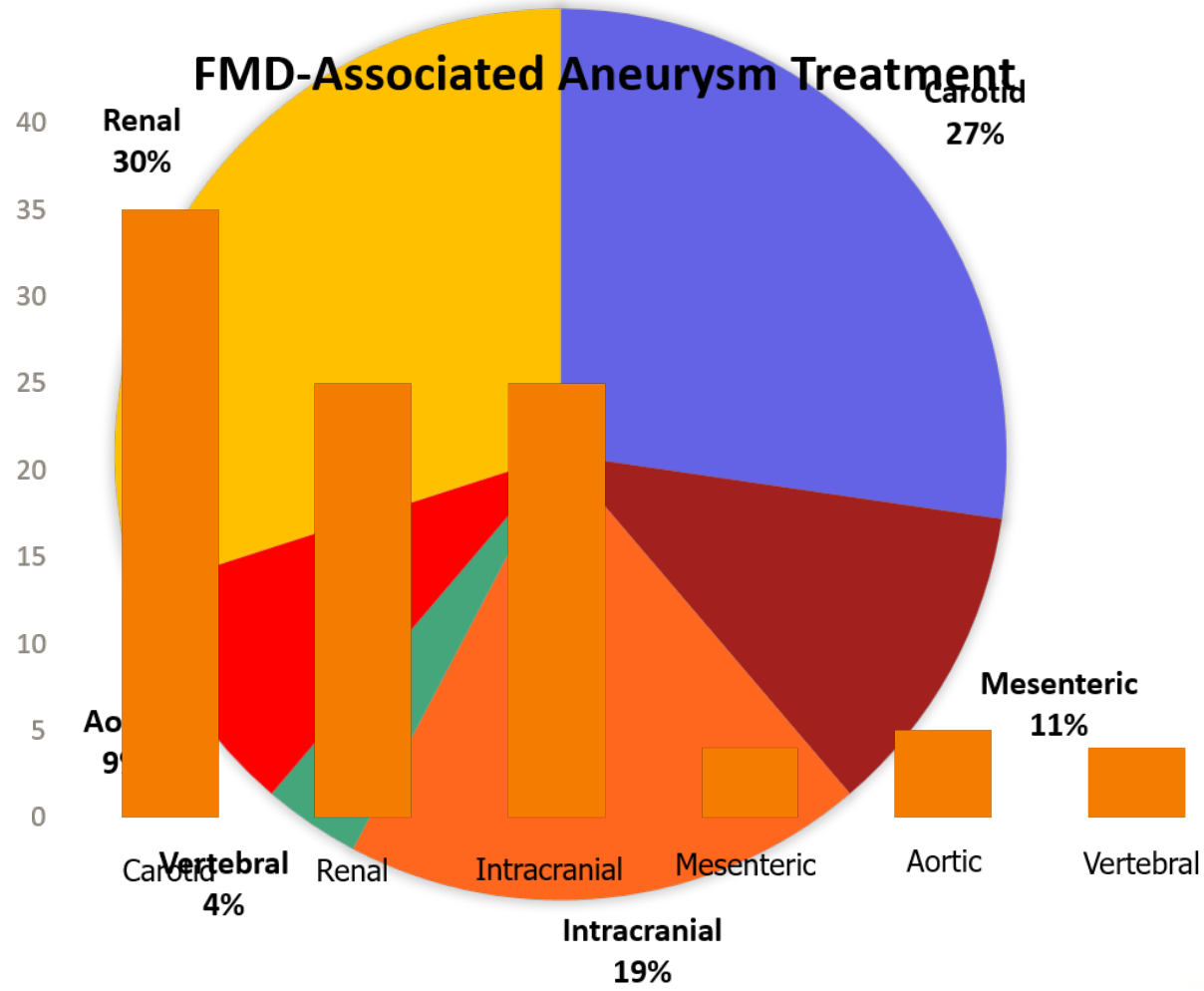
US Registry for FMD
n=921 patients

- *93.5% are female*
- *21.7% had 1 or more aneurysm*
- *41% had aneurysm at time of FMD diagnosis*
- *33% had aneurysm treatment*



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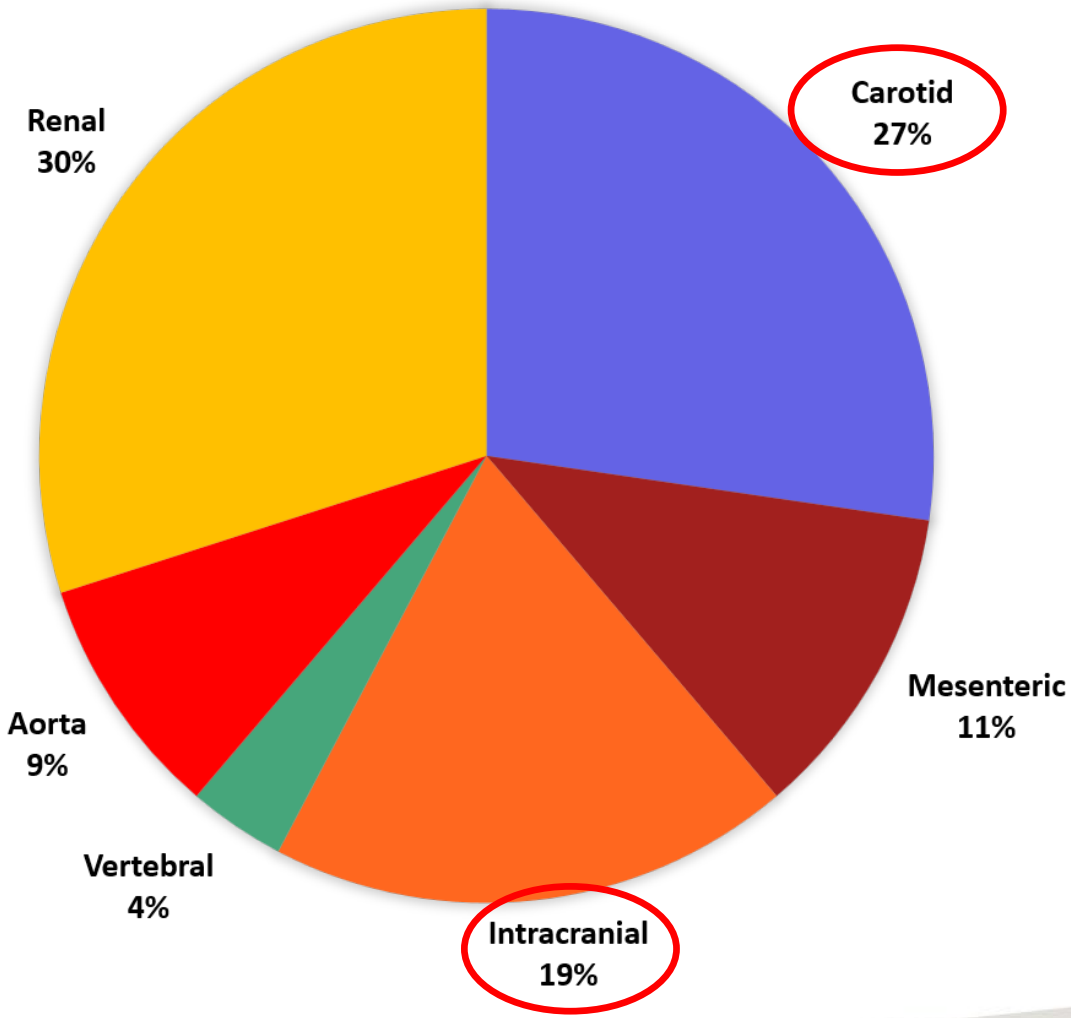

The Association of Intracranial Aneurysms in Women with Renal Artery Aneurysms

Hannah L. Hill,[1,2] James C. Stanley,[3] Niki Matusko,[3] Santhi K. Ganesh,[1,2] and Dawn M. Coleman,[3] Ann Arbor, Michigan

(Ann Vasc Surg 2019; 60: 147–155)

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Single center experience, n=83 women with RAA 2001-2016

- 15% had concomitant internal carotid or intracranial aneurysm
- Commonest location was cavernous internal carotid artery
- 15% had multifocal FMD, with multiple aneurysms in different tissue beds

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(J Vasc Surg 2020;72:3S-39S.)

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4.1: We suggest screening female patients of childbearing age with RAA for fibromuscular dysplasia with a focused history and one-time axial imaging study (ie, CTA or MRA) to assess for cerebrovascular and mesenteric artery dysplasia.

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Natural history and management of renal artery aneurysms in a single tertiary referral center

Adam J. Brownstein, BA,a Young Erben, MD,b Sareh Rajaee, MD,b Yupeng Li, PhD,c John A. Rizzo, PhD,d Hamid Mojibian, MD,e Bulat A. Ziganshin, MD, PhD,a,f and John A. Elefteriades, MD,a New Haven, Conn;

(J Vasc Surg 2023;77:1199-205.)

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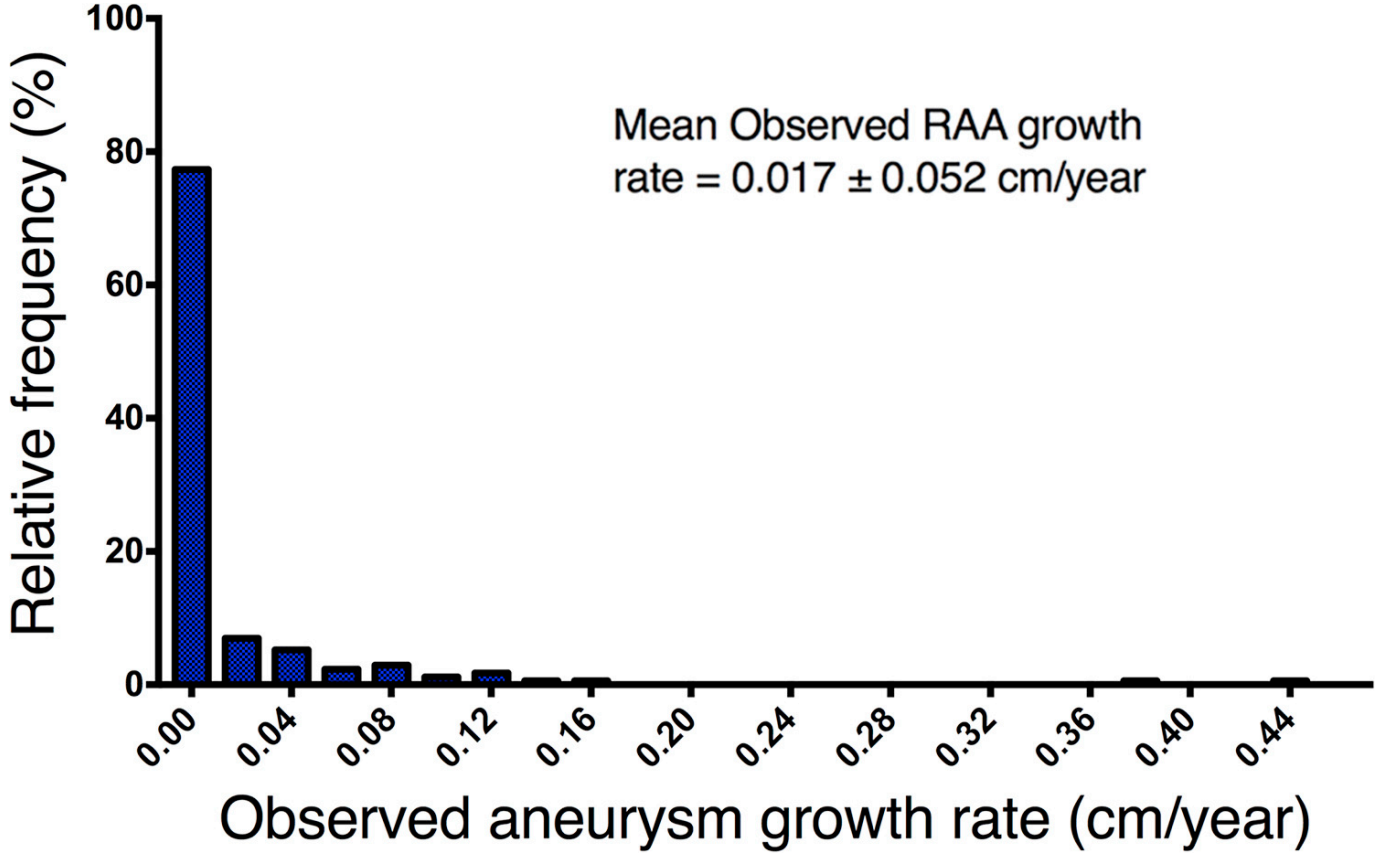
Yale University Hospital, n=259 RAA (1999-2016)

- *No ruptures* during follow-up (avg. 41 mo.), including 19 RAA >2 cm.
- *Low probability of growth*
- 2% (5/259) required repair: flank pain (1), hypertension (4)
- Avg. diameter 1.2 cm (unrepaired), 1.8 cm (repaired)

Renal aneurysm growth



Natural history of renal artery aneurysms

Jason Zhang, MD,[a] Keerthi Harish, BS,[a] Giancarlo Speranza, BS,[a] Charlotte A. Hartwell, MD,[b]
Karan Garg, MD,[a] Glenn R. Jacobowitz, MD,[a] Mikel Sadek, MD,[a] Thomas Maldonado, MD,[a] Danny Kim, MD,[b]
and Caron B. Rockman, MD,[a] New York, NY

(J Vasc Surg 2018;68:137-44.)

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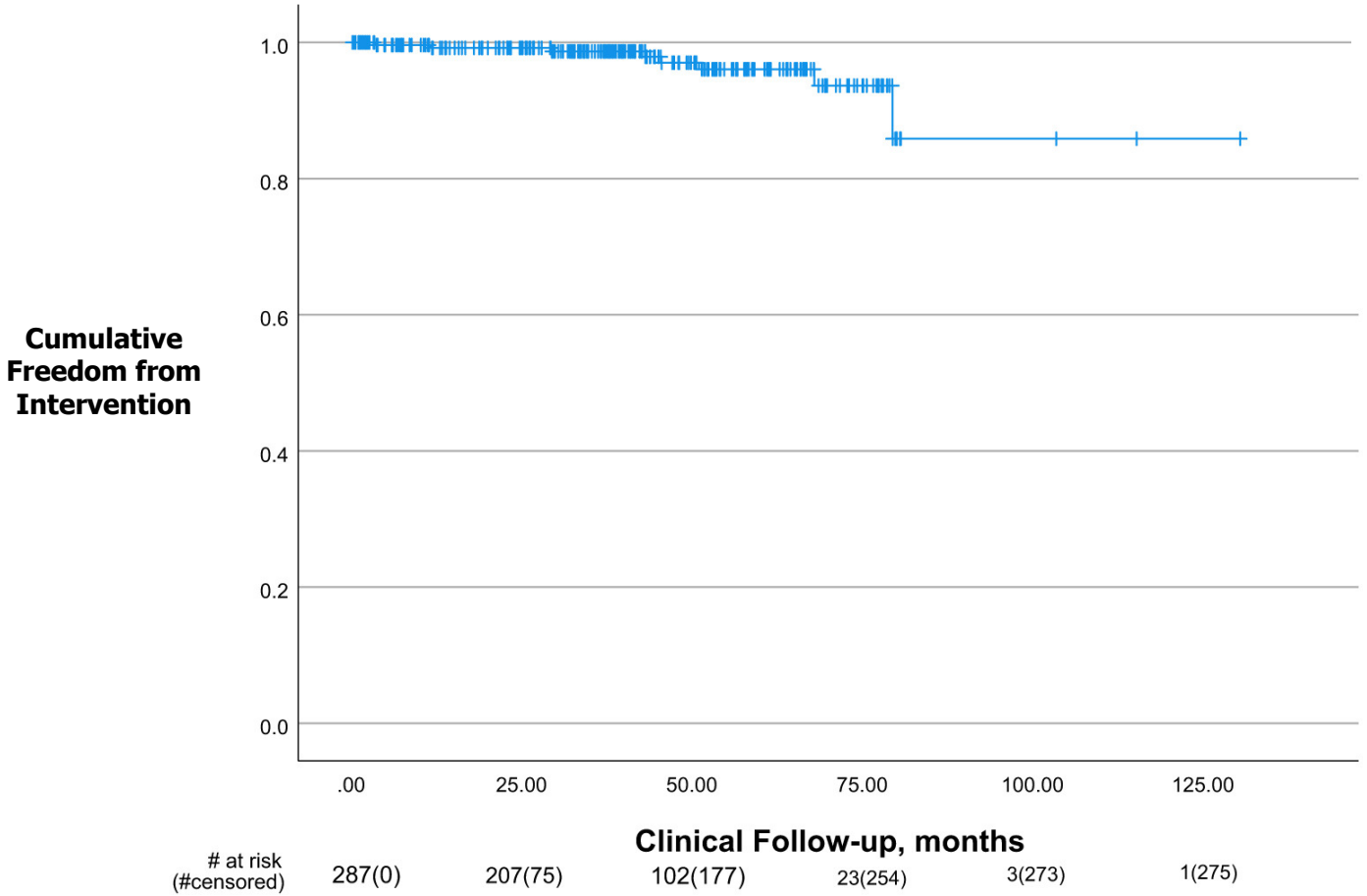
New York University Langone Hospital, n=338 RAA (2015-2019)

- *No ruptures* during follow-up (avg. 44 mo.), including 4 RAA >3 cm
- *Low probability of growth*
- 2.4% (8/338) required repair: rapid growth (4), flank pain (4)
- Avg. diameter 1.2 cm (unrepaired), 1.8 cm (repaired)

Freedom from intervention



The contemporary management of renal artery aneurysms

Jill Q. Klausner, BS,[a] Peter F. Lawrence, MD,[a] Michael P. Harlander-Locke, MPH,[a] Dawn M. Coleman, MD,[b] James C. Stanley, MD,[b] and Naoki Fujimura, MD,[c] for the Vascular Low-Frequency Disease Consortium, Los Angeles and Stanford, Calif; and Ann Arbor, Mich

(J Vasc Surg 2015;61:978-84.)

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n=865 RAA, 16 hospitals in North America, 2003-2013

- 0.3% ruptured (3/842), none with previously known aneurysm
- "Observation Group", avg. 29 mo. follow-up:
  - *No ruptures*
  - *Low probability of growth* (avg. < 1 mm./year)

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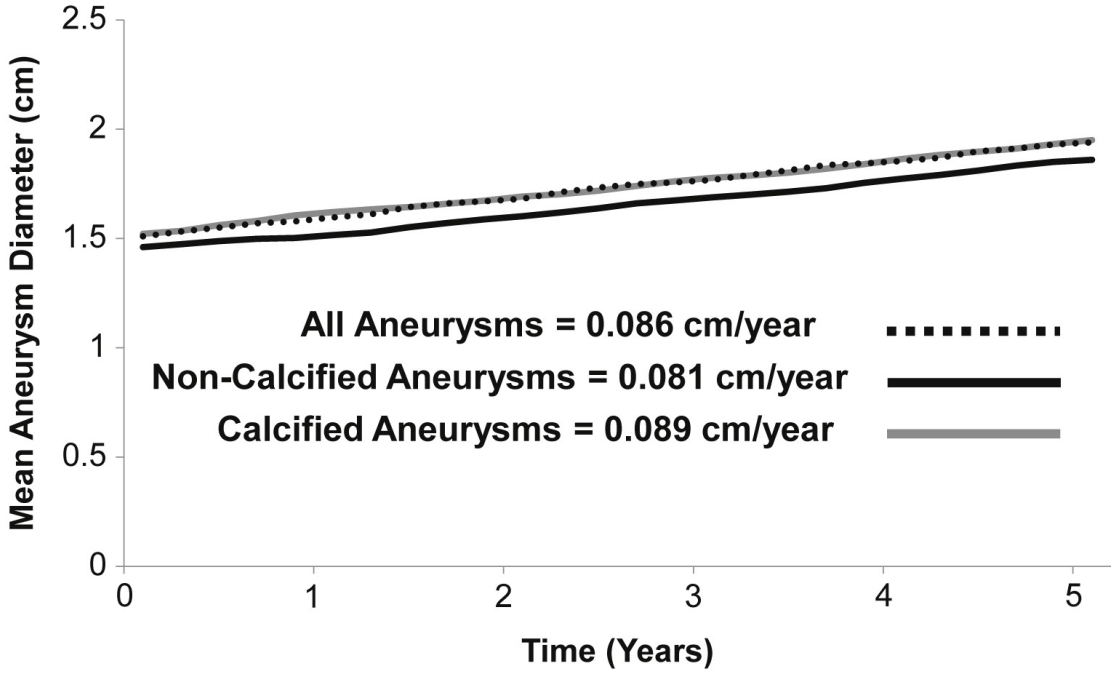
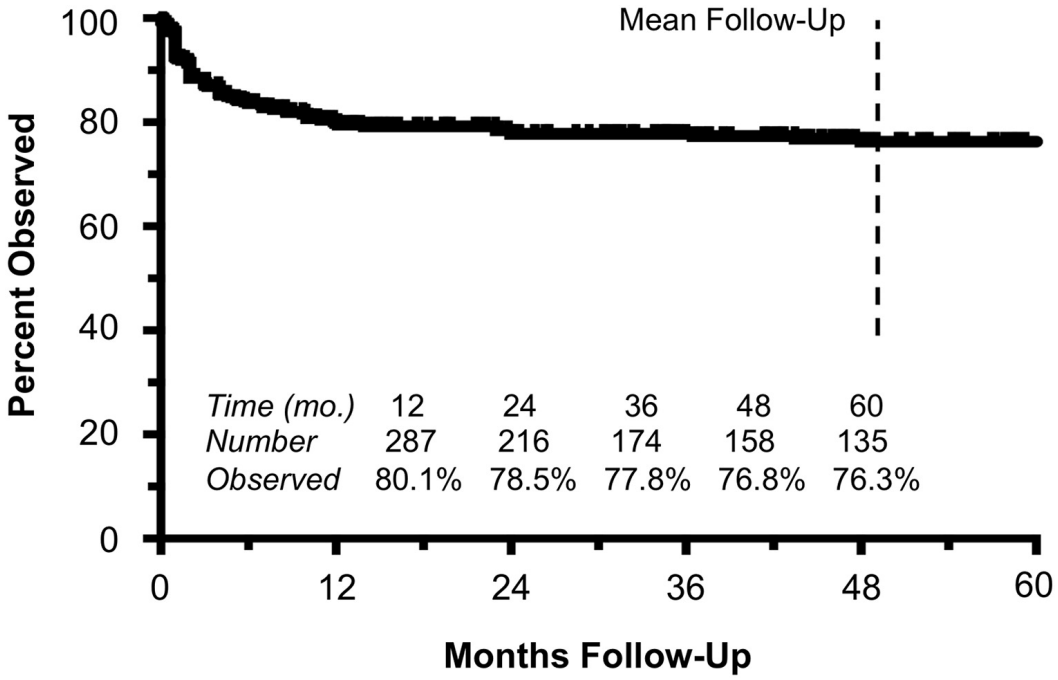
Growth Rate



Freedom From Intervention



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Overall:

1. Ruptures are extremely rare
2. Low probability of growth
3. Commonest indications for repair: rapid growth, flank pain, hypertension

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(J Vasc Surg 2020;72:3S-39S.)

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5.2: For patients managed nonoperatively, we suggest annual surveillance imaging until two consecutive studies are stable; thereafter, surveillance imaging may be extended to every 2 to 3 years.

SVS Clinical Practice Guidelines on the Management of Visceral Aneurysms

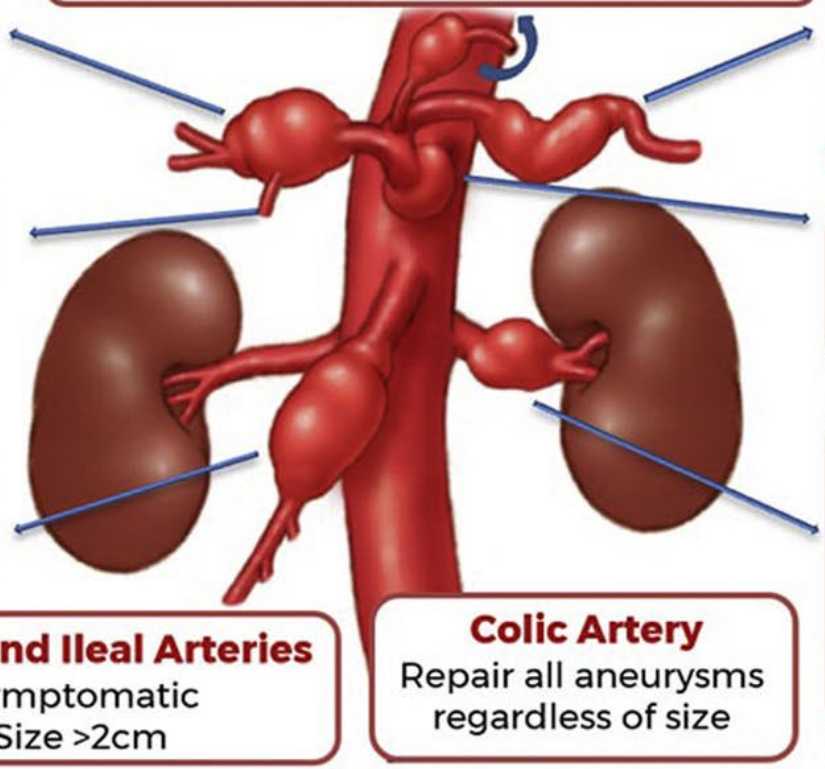
Hepatic Artery
- Symptomatic
- Size >2cm
- Growth >0.5cm/year

Pancreaticoduodenal and Gastroduodenal Arteries
Repair all aneurysms regardless of size

Superior Mesenteric Artery
Repair all aneurysms regardless of size

Jejunal and Ileal Arteries
- Symptomatic
- Size >2cm

Gastric and Gastroepiploic Arteries
Repair all aneurysms regardless of size



Colic Artery
Repair all aneurysms regardless of size

Splenic Artery
- All pseudoaneurysms
- Size > 3cm
- All sizes in women of childbearing age

Celiac Artery
- All pseudoaneurysms
- Size > 2cm

Renal Artery
- Symptomatic
- Size > 3cm
- All sizes
  - in women of childbearing age
  - in patients with refractory hypertension and renal artery stenosis

JVS Journal of Vascular Surgery
Official Publication of the Society for Vascular Surgery

Chaer et al. *J Vasc Surg, May 2020*

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SVS Guidelines: Indications for renal aneurysm repair

1. *Aneurysm size > 3 cm.*
2. *Any size:*
    i. *Symptomatic or ruptured*
    ii. *Persons of childbearing potential*
    iii. *Refractory hypertension or functionally important renal artery stenosis*

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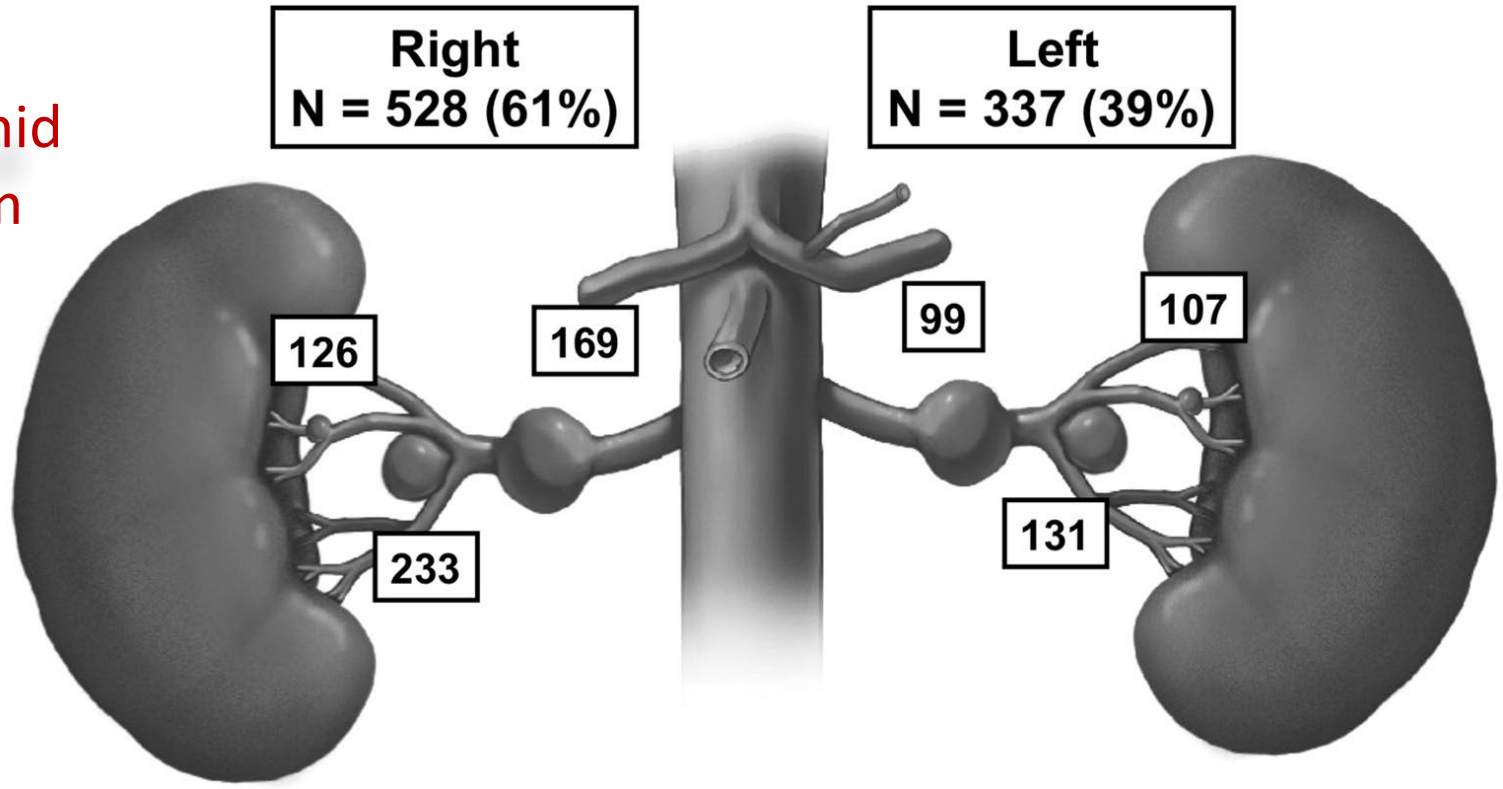
(J Vasc Surg 2015;61:978-84.)

N=865

39% proximal/mid

69% distal/hilum



Renal Artery Aneurysms

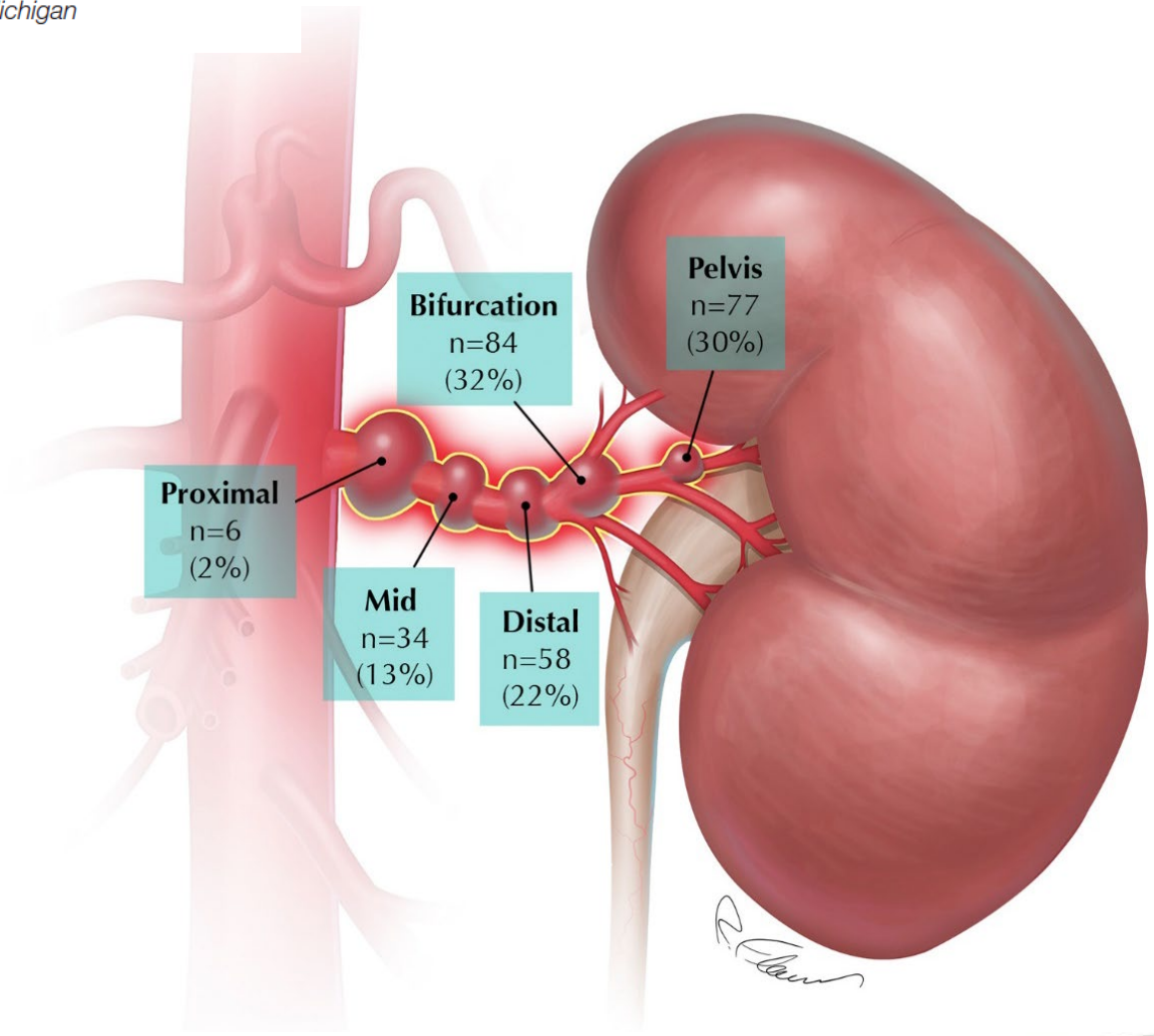
A 35-Year Clinical Experience With 252 Aneurysms in 168 Patients

Peter K. Henke, MD, Jeffry D. Cardneau, MD, Theodore H. Welling III, MD, Gilbert R. Upchurch, Jr., MD,
Thomas W. Wakefield, MD, Lloyd A. Jacobs, MD, Shannon B. Proctor, Lazar J. Greenfield, MD, and James C. Stanley, MD

From the Department of Surgery, Section of Vascular Surgery, University of Michigan, Ann Arbor, Michigan

(J Vasc Surg 2015;61:978-84.)

N=252 RAA
29% proximal/mid
71% distal/hilum



Reconstruction for renal artery aneurysm: Operative techniques and long-term results

Tomas Pfeiffer, MD, Lutz Reiher, Klaus Grabitz, Benjamin Grunhage, Sebastian Hafele, Adina Voiculescu, Gunter Furst, and **Wilhelm Sandmann,** *Dusseldorf, Germany*

(J Vasc Surg 2003;37:293-300.)

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83 open repairs of aneurysms in mainstem renal artery

96% success, 17% complication, 1.2% mortality,

81% long-term patency (avg. 44 mos.)

7.2% late interventions (renal artery stenosis)

Results of current endovascular treatments for visceral artery aneurysms

Aaron T. Fargion, MD, Roberto Falso, MD, Sara Speziali, MD, Brigida Biancofiore, MD, Davide Esposito, MD, Elena Giacomelli, MD, PhD, Walter Dorigo, MD, and Raffaele Pulli, MD, Florence, Italy

J Vasc Surg 2023;78:387-93

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Repair of proximal or mid- renal artery aneurysm: 72 endo, vs. 54 open repairs

Endo: 96% success, 5.8% complication, 0% mortality

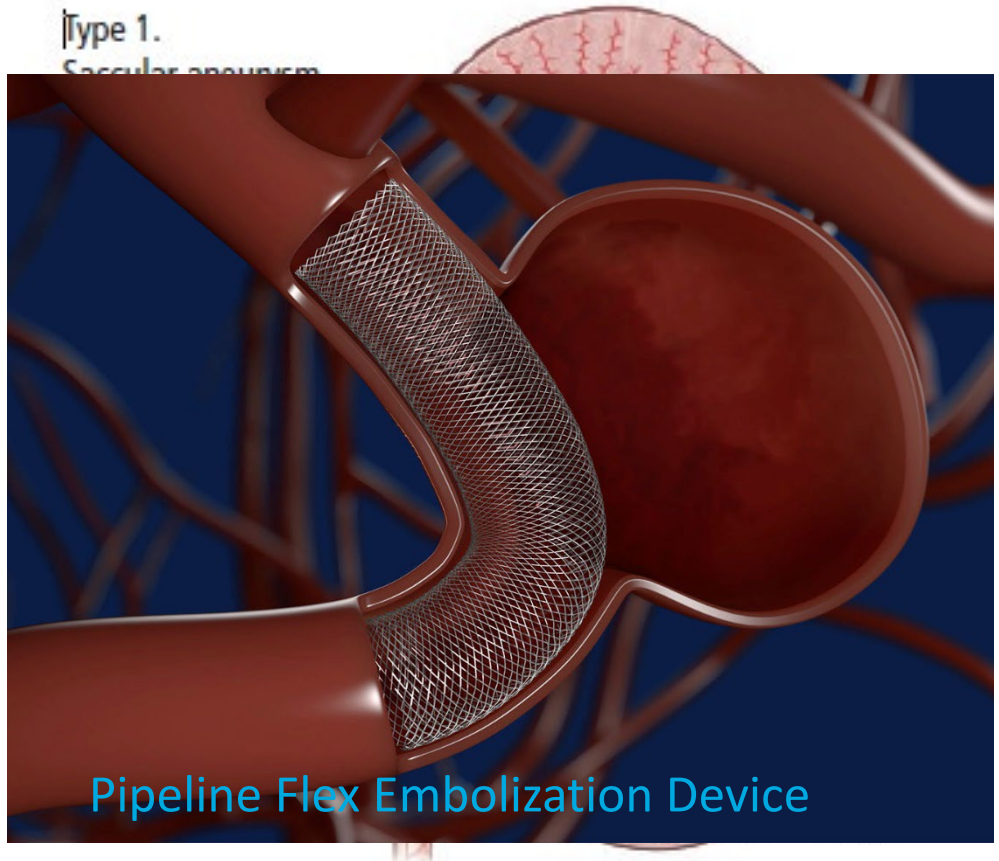
7-yr. complication-free (patency, endoleak) = 85.5%

7-yr. reintervention = 6.9%

No significant differences in reintervention or aneurysm-related survival, endo vs. open repair.

Treatment options for distal renal artery, or renal hilum aneurysms

- Surgical resection
- Endovascular sac occlusion (coiling/liquid)
- Endovascular occlusion of aneurysm inflow, with distal parenchymal infarction
- Covered stent or flow diverting stent exclusion of aneurysm



Direct Distal Renal Artery Aneurysm Repair

Jérémie Jayet [a,*,‡], Jean-Michel Davaine [a,b,‡], Philippe Tresson [a], Dorian Verscheure [a], James Lawton [a], Mahine Kashi [a], Thibault Couture [a], Julien Gaudric [a], Laurent Chiche [a], Fabien Koskas [a]

[a] Vascular and Endovascular Surgery Department, University Hospital of La Pitié-Salpêtrière, Paris, France
[b] Sorbonnes Universités UPMC Univ Paris 06, UMRS 1138, Centre de recherche des Cordeliers, Paris, France

Eur J Vasc Endovasc Surg (2020) 60, 211—218

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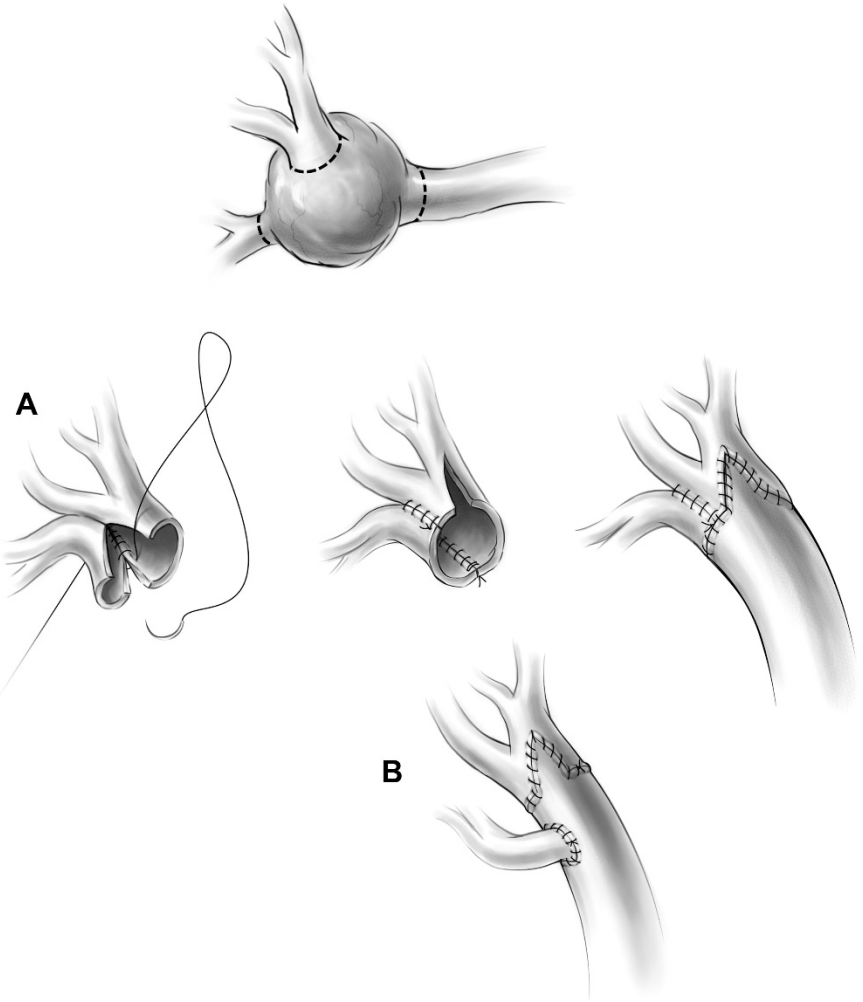
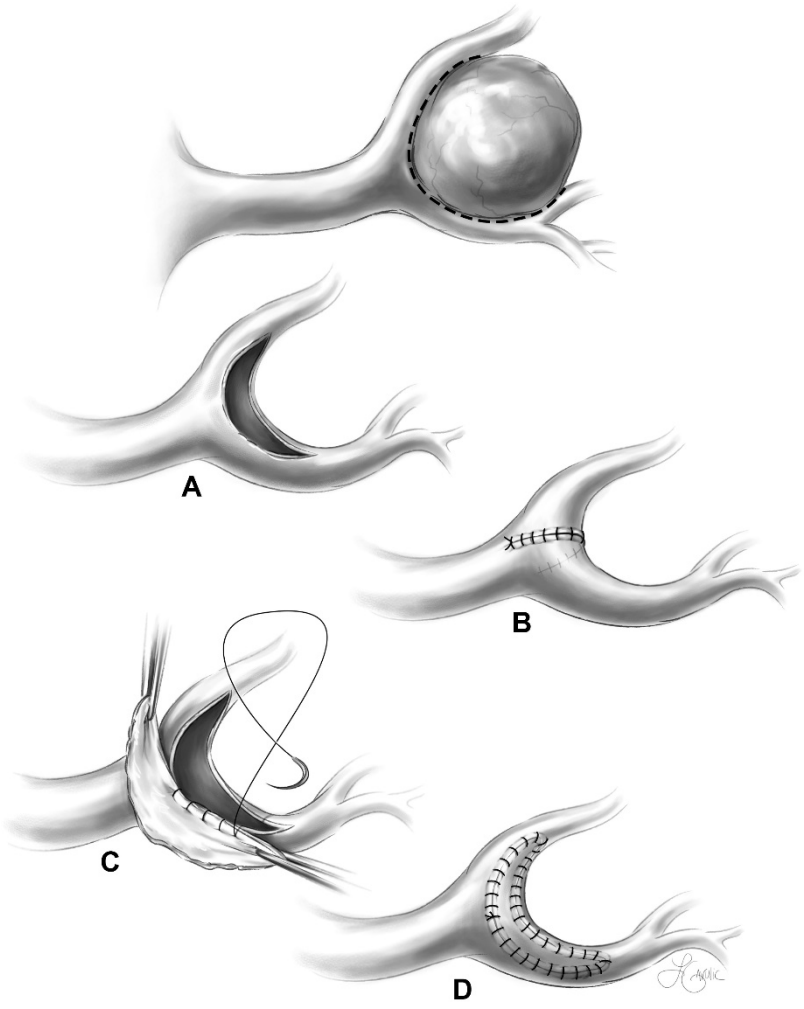
Single center experience (2015-2018, n=24) → direct resection of RAA

- 24% had major postoperative complication: post-op bleed (26%), wound infection (13%), cardiac (7%)
- Age, COPD predictive of any complication, especially post-op bleed and wound infection
- 2 years post-op: 100% patency
  no deterioration of renal function
  significant improvement in hypertension


A
B


A
B
C
D

A Qualitative Systematic Review of Endovascular Management of Renal Artery Aneurysms

Kevin P. Sheahan, BBL, MB BCh BAO, MCh, Imran Alam, BSc, MSc, Tugche Pehlivan, BSc, Edoardo Pasqui, MD, Hayley Briody, MB BCh, Hong Kuan Kok, MB BMedSci, Hamed Asadi, MD, PhD, andMichael J. Lee, MB BCh, MSc

J Vasc Interv Radiol 2024; 35:1127–1138

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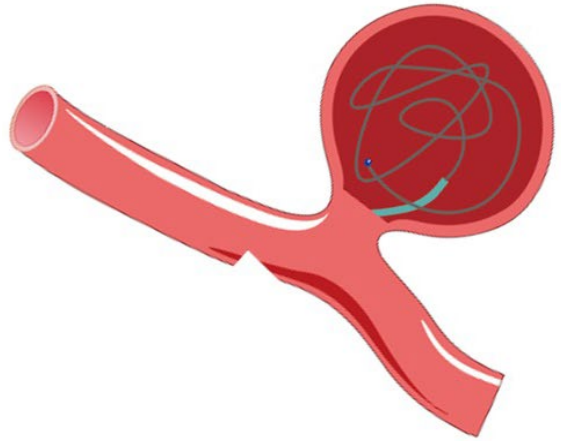


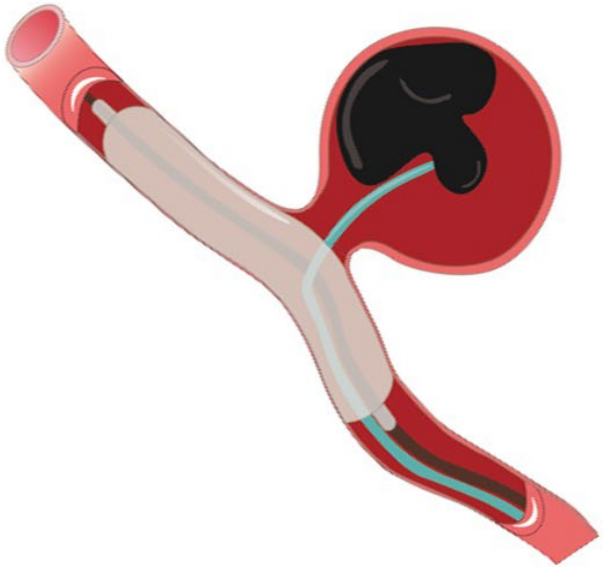
Systematic review of 26 studies, avg. 27 mo. follow-up

N=454 distal/hilum RAA: 87% had embolization of aneurysm sac or inflow/outflow vessel

96% Technical success, 0% mortality

11.5% “clinically significant” renal infarction, “silent” infarction in 84%

<u>4% late reperfusion, requiring reintervention</u>



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5.1: We suggest completion imaging after open surgical reconstruction for RAA, before hospital discharge, by way of axial imaging with CTA or MRA or arteriography in select cases, and *long-term follow-up with surveillance imaging.*

Renal Artery Aneurysms:

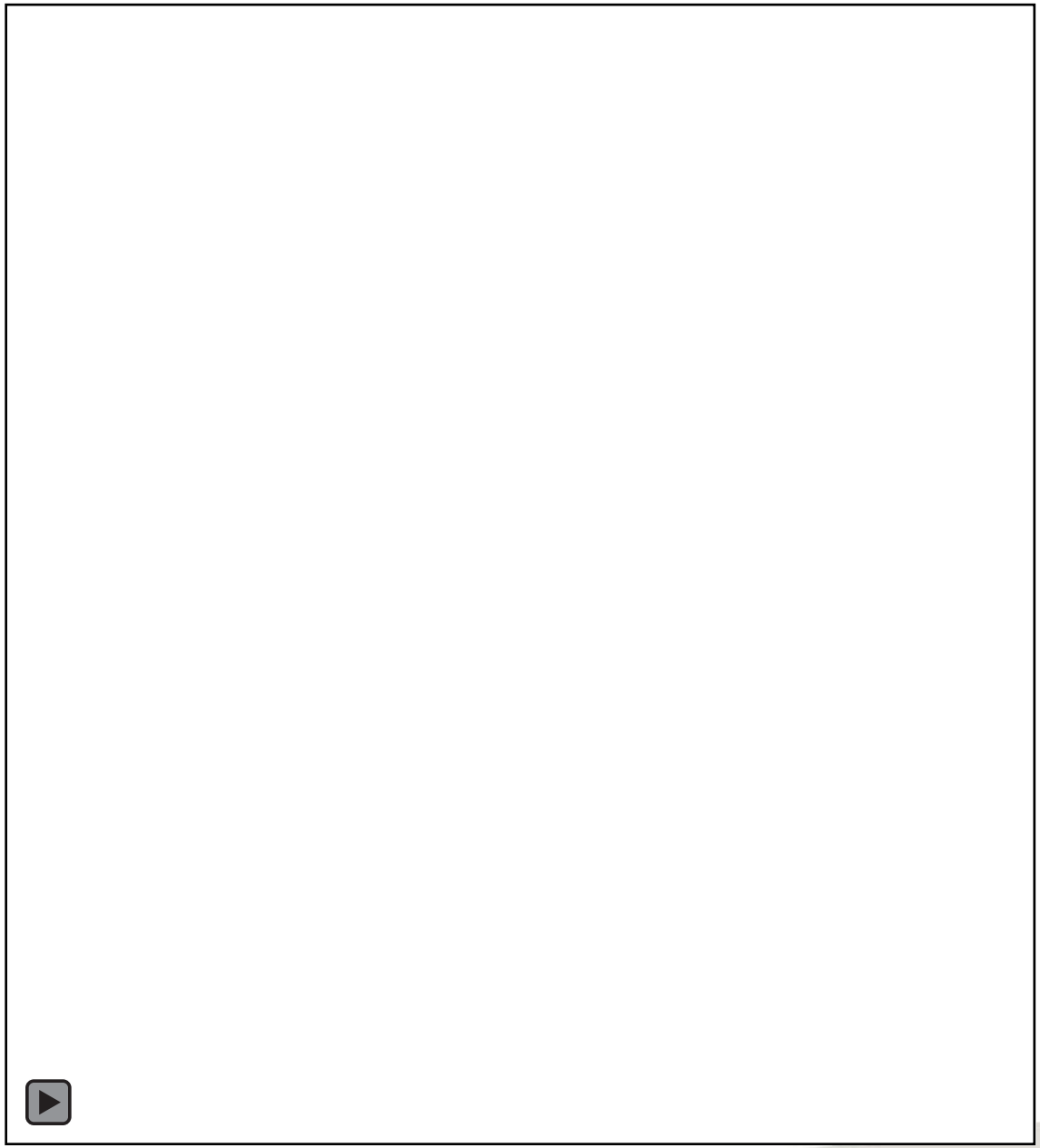
1. *Female preponderance*
2. *Slow growing, rarely symptomatic/rupture*
3. *Most occur in distal circulation (hilum, parenchyma)*
4. *Associated with hypertension*
5. *Think FMD, especially in females*

Management:

1. *Repair if >3 cm, symptomatic (pain, uncontrolled hypertension), or any size in person of childbearing age*
2. *Monitor all others*
3. *Screen for mesenteric, carotid/intracranial disease if FMD suspected*
4. *Near equivalency of endovascular and open repair; endo repair less morbidity, shorter LOS*
5. *Long-term imaging is necessary after endo repair, to detect treatment failures*

Case 1 :

- *74 y.o. healthy female*
- *1.4 cm saccular aneurysm at hilum → stable >2 years, asymptomatic*
- *Solitary left kidney*
- *Normal GFR*
- *hypertension → single agent*

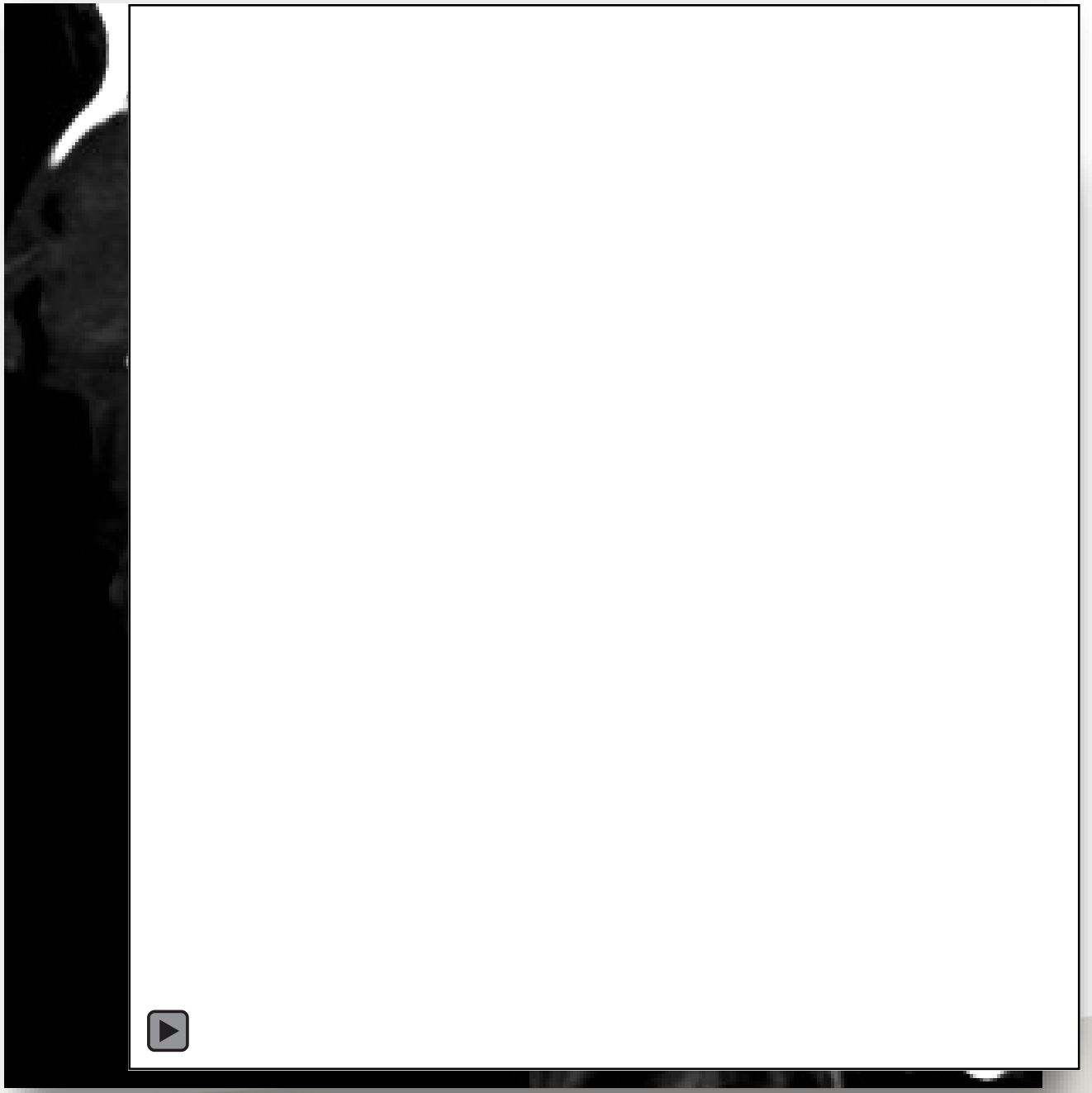


Case 2 :

- *56 y.o. male (heavy-duty mechanic, smoker)*
- *fusiform aneurysm of distal renal artery, asymptomatic*
- *Normal GFR*
- *hypertension → 3 agents, with poor control*

Case 3 :

- *37 y.o. healthy female*
- *1.9 cm saccular aneurysm in hilum, asymptomatic*
- *Splenic artery aneurysms, <1 cm.*




Thank you!