Spontaneous Coronary Artery Dissection: Time to Improve Our Systems of Care

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American Heart Association.

Spontaneous Coronary Artery Dissection: Time to Improve Our Systems of Care

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Conflicts of Interest

- Research Funding
  - SCAD Research Inc, Scottsdale, AZ
  - Minneapolis Heart Institute Foundation, Minneapolis, MN

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Spontaneous Coronary Artery Dissections

- Case Study
- Diagnosis
- Acute Management
- Long Term Management / Follow-up

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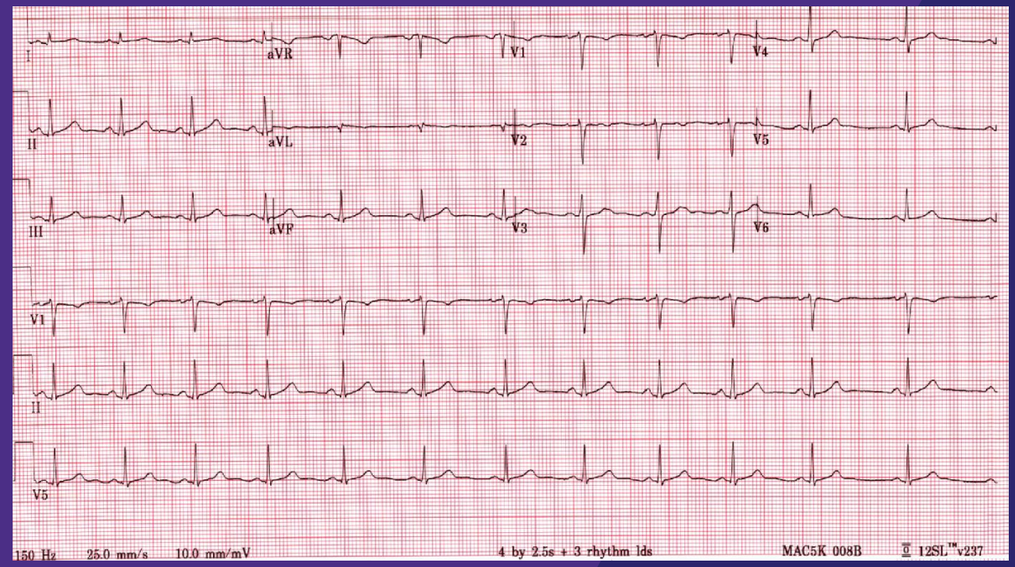
Case: 64 year old woman with chest pain

- Sudden onset of severe sharp mid chest pain radiating to her left arm
- Past Medical History:
  - Mixed atherosclerotic and embolic CAD
  - Vasospasm
- Medications
  - Atorvastatin
  - Aspirin
  - Ranolazine
  - Amlodipine
- Vitals: BP 120/90, P 63, T 36.1C, SpO2 97%
- Exam: Unremarkable
- Labs: BMP, CBC normal, Troponin positive at 0.1 mcg/L
- Admitted for NSTEMI with standard treatment



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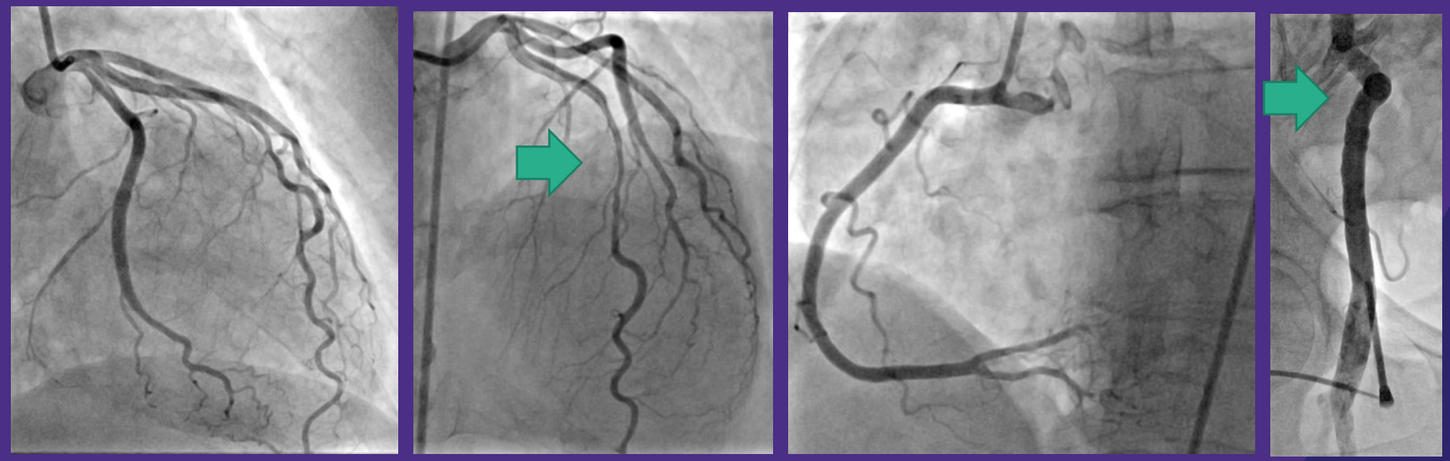
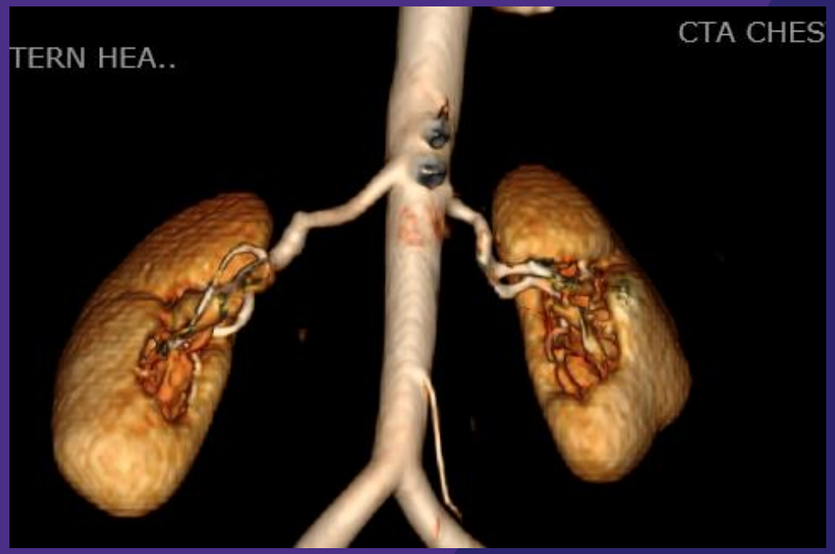
SCAD of the Proximal to Mid LAD



SCAD with Fibromuscular Dysplasia: A Unifying Diagnosis

Femoral Artery

Carotid Arteries



Renal Arteries

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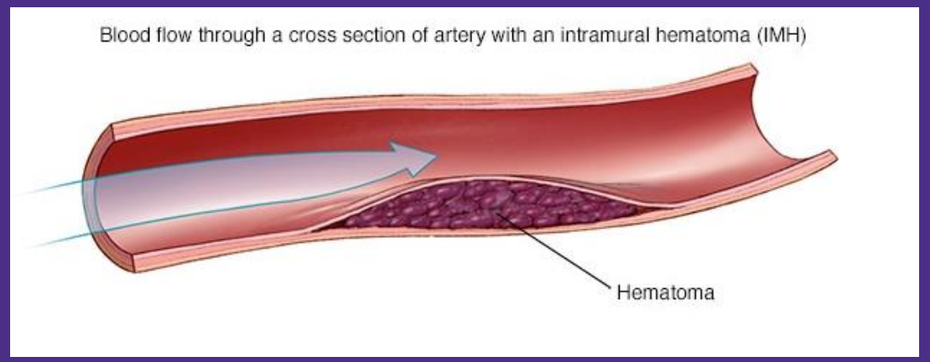
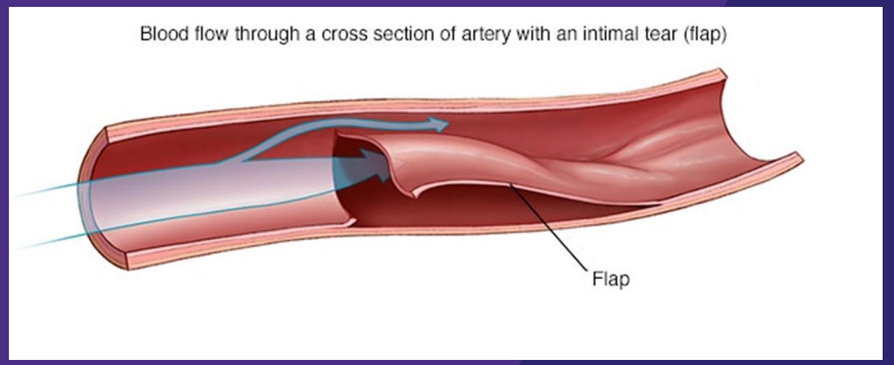
What is SCAD?

- Separation of coronary artery intima from media (dissection) by hematoma resulting in coronary lumen obstruction





From: <https://www.mayoclinic.org/diseases-conditions/spontaneous-coronary-artery-dissection/symptoms-causes/syc-20353711>

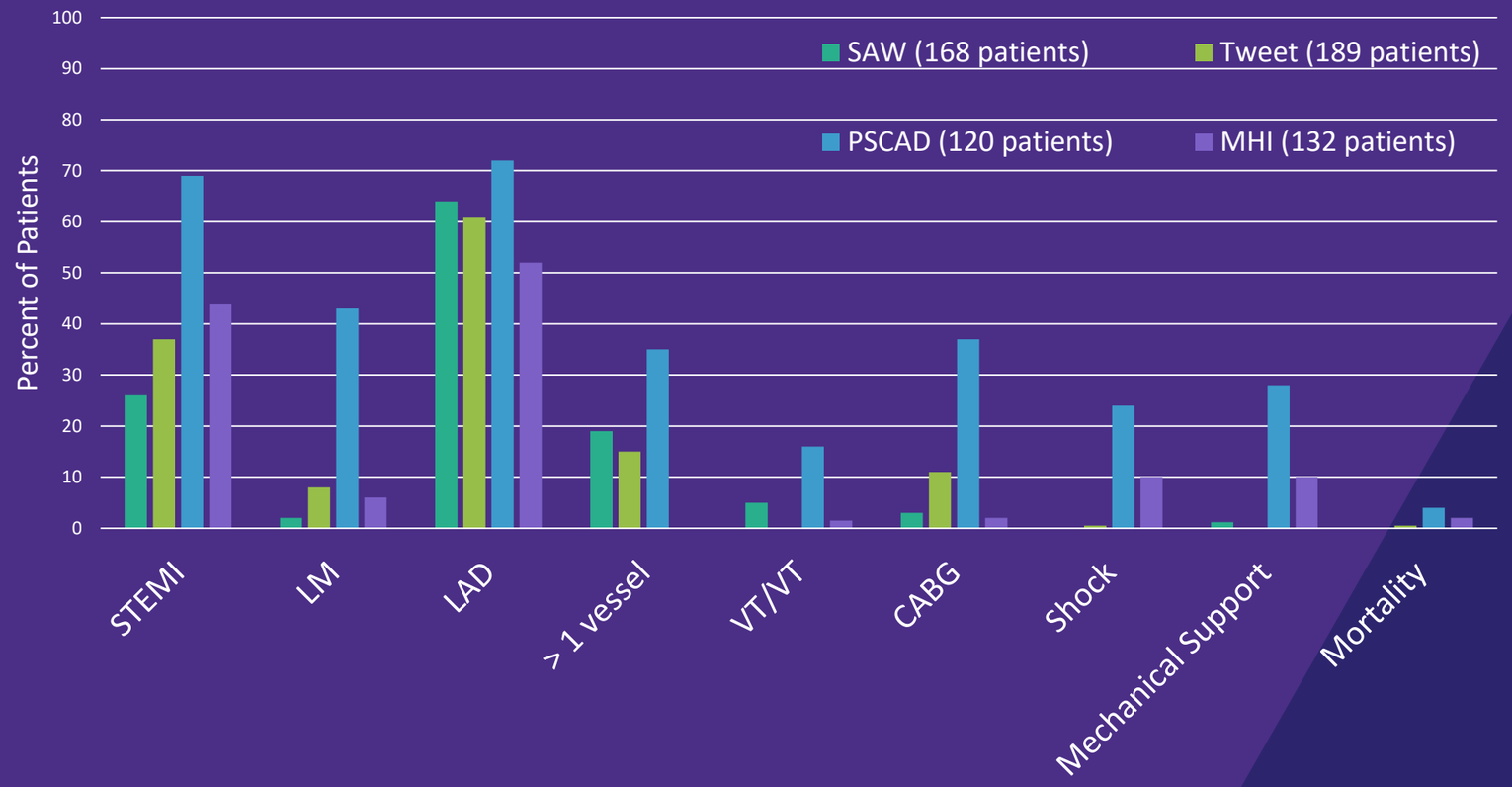
Demographics

Table I Demographics and risk factors of patients with spontaneous coronary artery dissection (SCAD) in contemporary case series (studies with $n > 20$)

	Max N	Age (years)	Gender (female, %)	HTN (%)	Chol (%)	Smoking (%)	DM (%)	FH (%)	P-SCAD (%)
Mayo Clinic[3]	189	44 ± 9	92	31	22	15	2	NA	15
Saw[4]	168	52 ± 9	92	39	24	13	5	29	2
Lettieri[5]	134	52 ± 11	81	51	33	34	2	25	NA
Faden[6]	79	33 ± 5	100	17	18	17	11	NA	100
Rogowski[7]	64	53 ± 11	94	45	52	28	0	19	5
Nakashima[8]	63	46 ± 10	94	33	23	32	0	8	8
Motreff[13]	55	50	100	27	11	22	4	22	4
McGrath-Cadell[9]	40	45 ± 10	95	18	10	8	5	28	8
Roura[10]	34	47 ± 12	94	NA	NA	NA	NA		15
Alfonso[11]	27	52 ± 10	85	37	33	52	4	NA	4
Ito[12]	23	45 ± 11	100	57	22	30	4	NA	30
Vanzetto[14]	23	46 ± 9	74	26	39	43	13	13	0
Mortensen[15]	22	49 ± 9	81	38	NA	57	0	40	10
Rashid[16]	21	53 ± 9	95	48	48	47	5	24	0

Adlam, David, et al. "Spontaneous coronary artery dissection." *Eur Heart J* (2016) 37: 3073-3074.

SCAD Presentation



Modified From: Havakuk, Ofer, et al. *Circulation: Cardiovascular Interventions* (2017) 10 (3): e004941.

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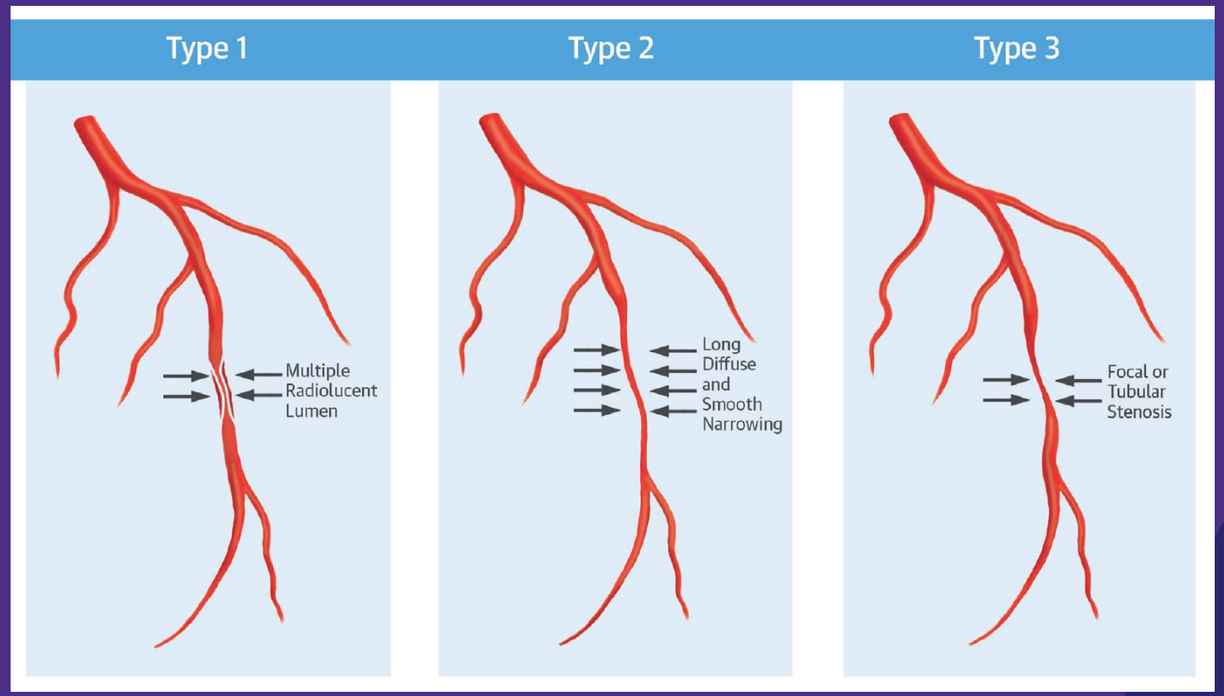
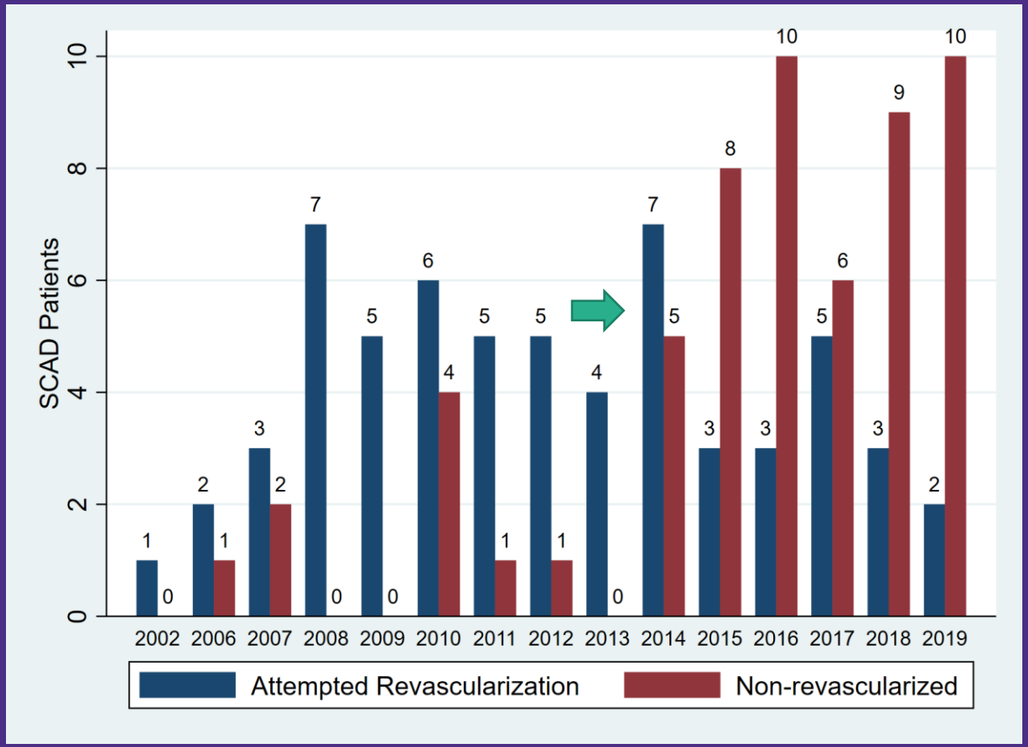
Diagnosis by Angiogram



Saw et al. J Am Coll Cardiol 2017;70:1148–58.

SCAD Revascularization Rate By Year at MHI



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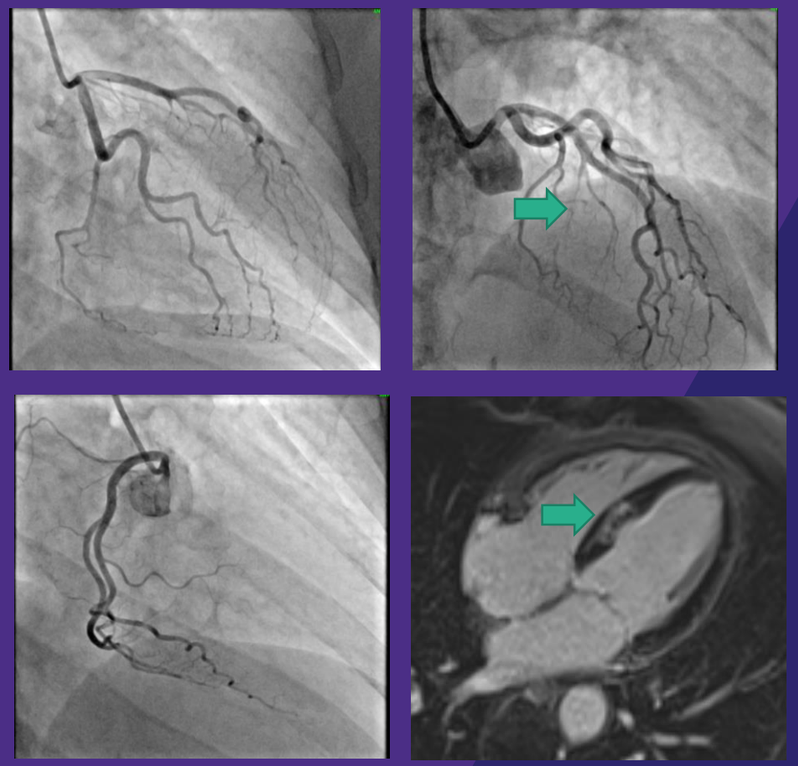
Multimodality Imaging Enhances SCAD Diagnosis

- Optical Coherence Tomography / Intravascular Ultrasound to Confirm Dissection
  - Improved spatial resolution
  - Only recommend if diagnosis is unclear due to dissection risk
- CT Coronary Angiography
  - Exclude significant atherosclerotic disease
  - Useful to visualize proximal dissections
- Cardiac MRI
  - Diagnose and confirm location of myocardial infarction

Cardiac MRI in Diagnosis of SCAD

- 60 year old woman without significant medical history had NSTEMI with troponin to 12
- Angiogram with “normal coronary arteries”
- cMRI transmural infraction of the basal to mid interventricular septum with wall motion abnormality

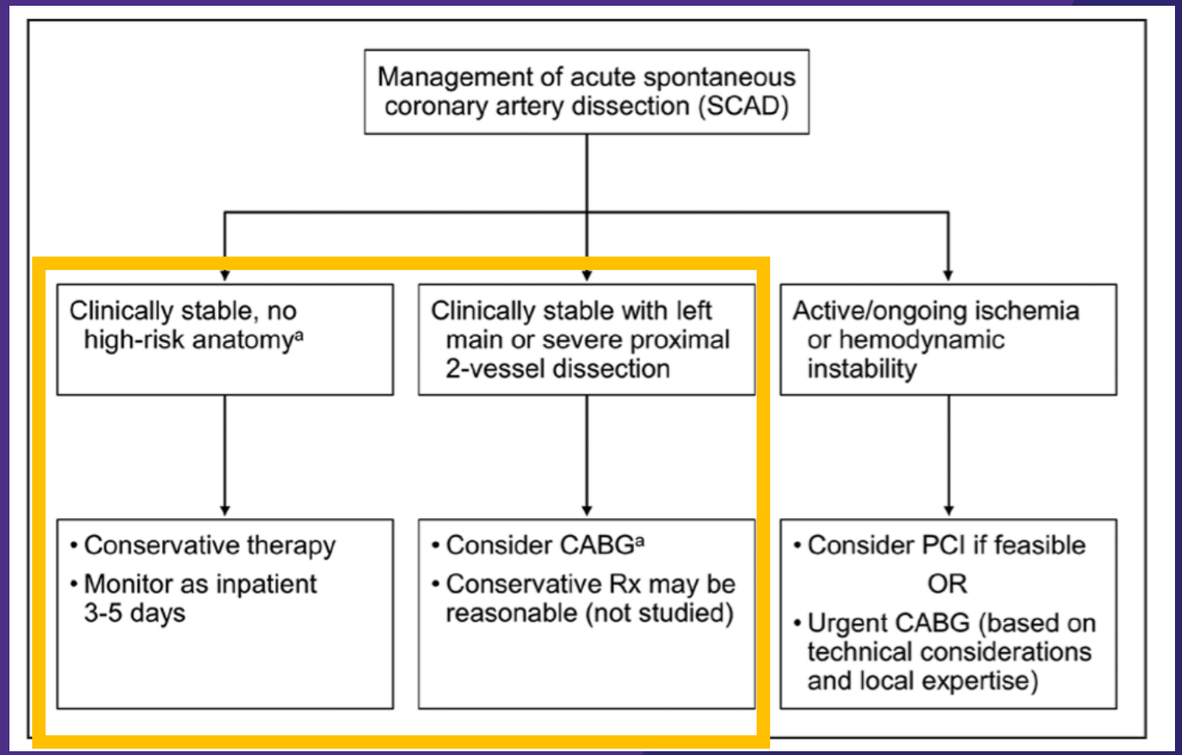


Diagnosis of SCAD

- Diagnosis can be challenging
- Coronary Angiography primary modality for diagnosis
- Multimodality Imaging can augment coronary angiography

Acute Management

- Spontaneous healing 70-90%
  - **Predominantly NSTEMI**
- Often healed by 1 month
- Repeat angiography only based on clinical symptoms



Hayes et al, *Circulation. 2018; 137(19): e523-557.*

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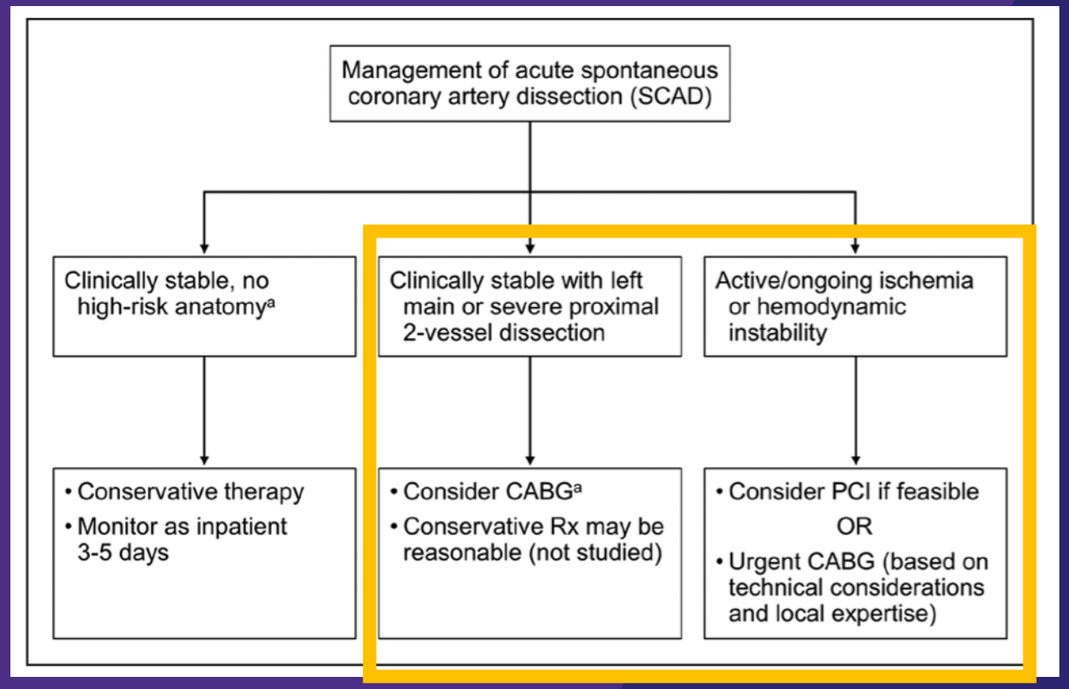
SCAD Revascularization

- Technically Challenging
- Technical failure: 25-36%
- Suboptimal results: 25%
- Emergency CABG 9-12%



Hayes et al, *Circulation. 2018; 137(19): e523-557.*

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Iatrogenic Dissection

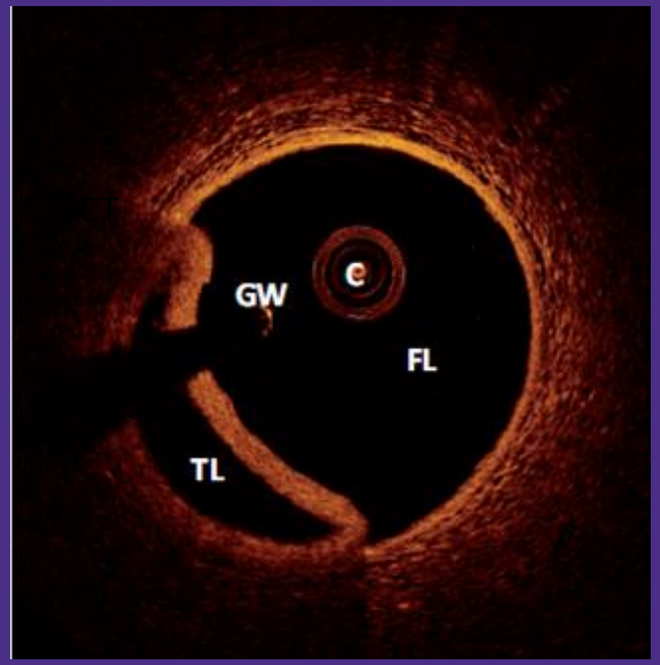
- 3.4% of SCAD Patients vs <0.2% general population
- Increased Risk
  - Radial approach
  - Deep catheter intubation

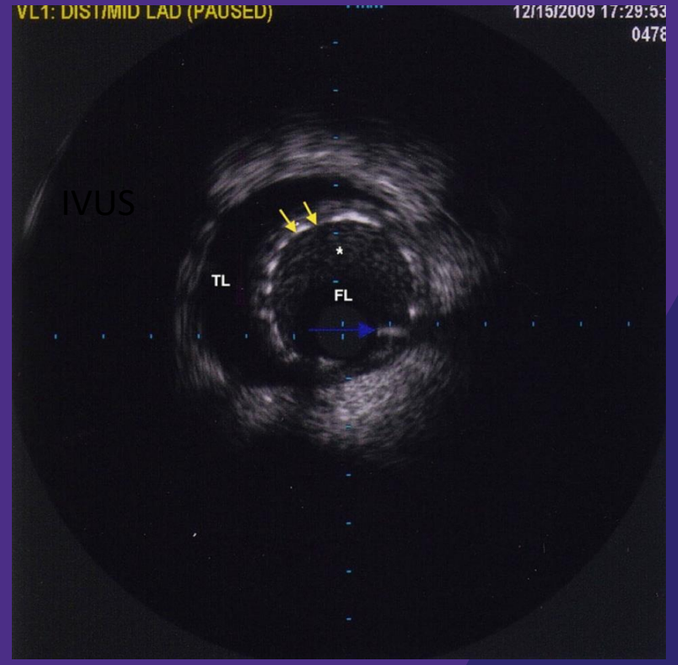
Right Coronary Artery Iatrogenic Dissection

Left Anterior Descending Artery Spontaneous Dissection

Prakash, Roshan, et al. "Catheter-induced iatrogenic coronary artery dissection in patients with spontaneous coronary artery dissection." *JACC: Cardiovascular Interventions*. (2016) 9(17): 1851-1853.

False Lumen Stenting

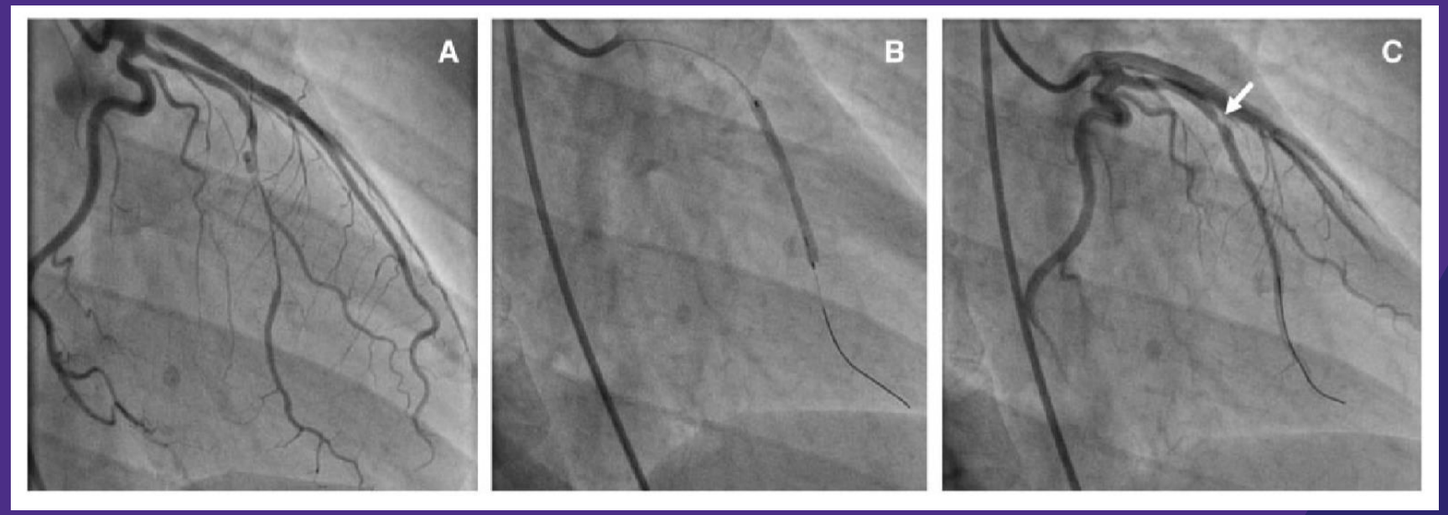




Adlam, David, et al. "Spontaneous coronary artery dissection." *Eur Heart J* (2016) 37: 3073-3074.

Kalra, Ankur, et al. "Percutaneous coronary intervention in spontaneous coronary artery dissection: role of intravascular ultrasound." *Cardiology and therapy* (2014) 3(1-2):61-66.

Dissection Propagation

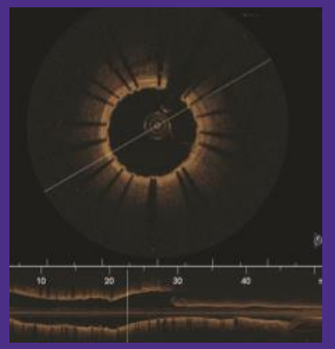


SCAD in High OM | Stent Inflation | Dissection Propagation

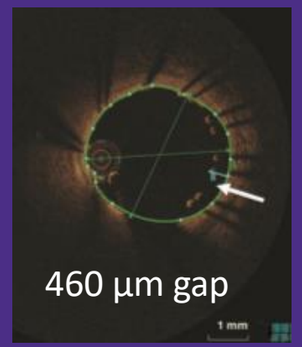
Adlam, David, et al. "Spontaneous coronary artery dissection." *Eur Heart J* (2016) 37: 3073-3074.

Late Hematoma Resorption with Stent Malapposition

9 days after PCI for mLAD SCAD



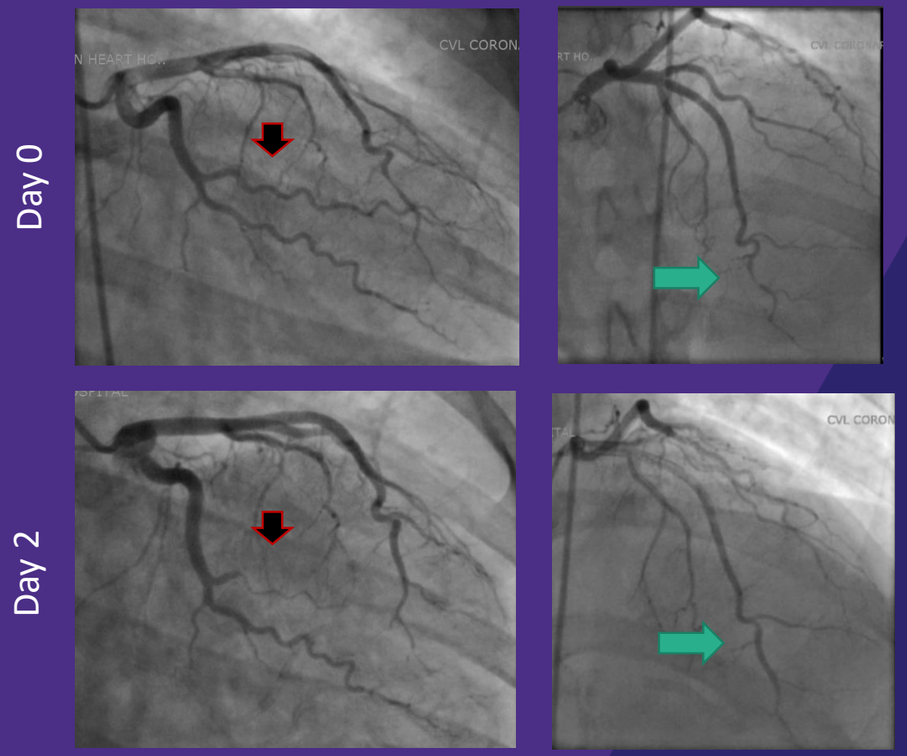
2 days later after 2nd PCI



Lempereur et al. *Cardiovasc Diagn Ther* 2015; 5(4): 323-329.

Progression in New Vessels During Index Admission

- 5-20% of patients will have early progression of disease
- 2.6-8.5% will fail conservative treatment
- Hospitalized minimum 48 hours, up to 5 day can be justified



Waterbury Circ Cardiovasc Interv. 2018;11:e006772.

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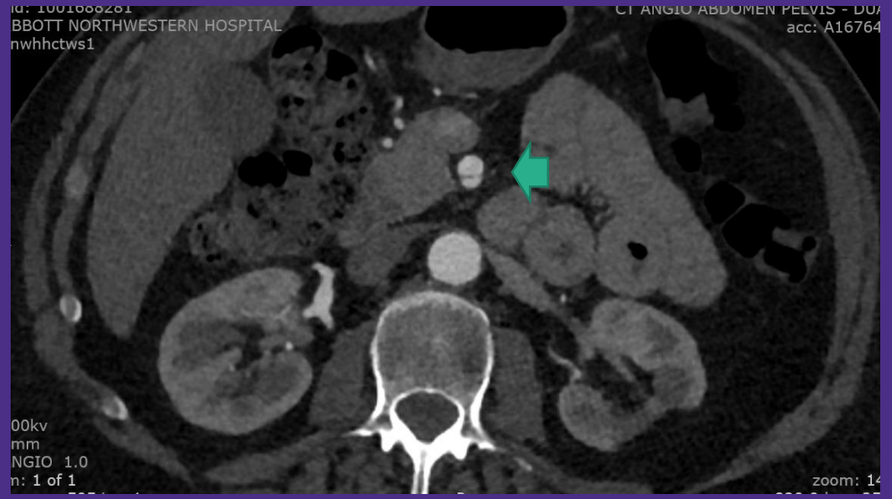
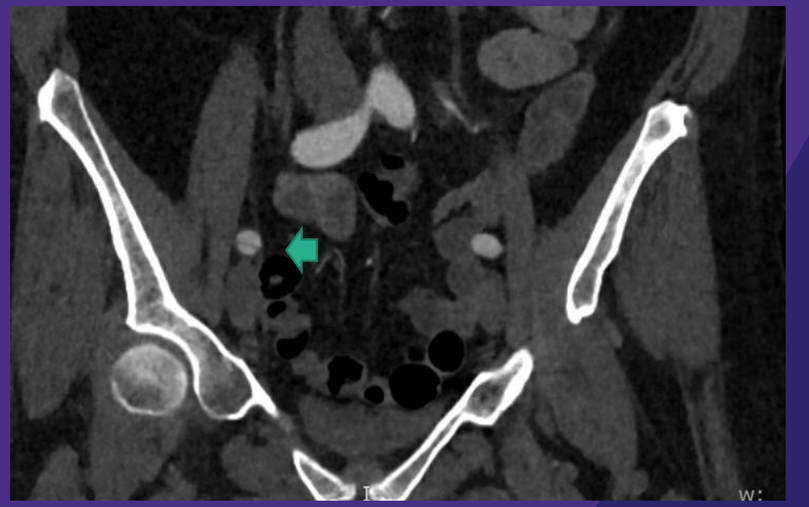
Non-Coronary Dissections



Spontaneous Superior Mesenteric Artery Dissection



Iatrogenic Femoral Artery Dissection

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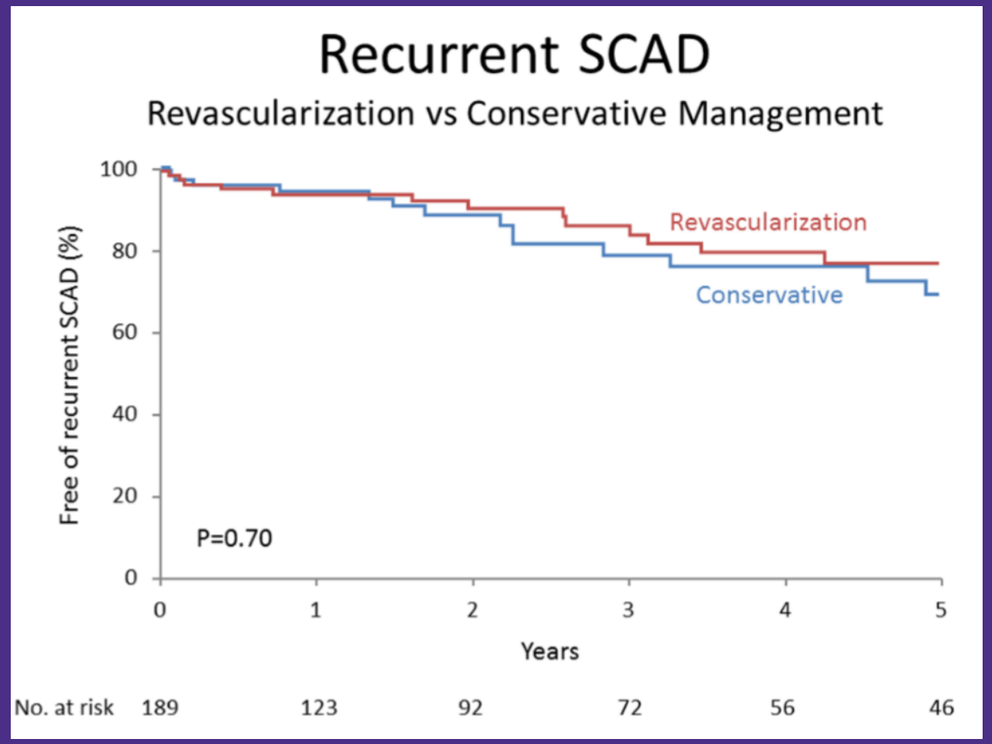
PCI Is NOT Protective From Recurrent SCAD



Tweet, Marysia S., et al. *Circulation: Cardiovascular Interventions* (2014) 7(6): 777-786.

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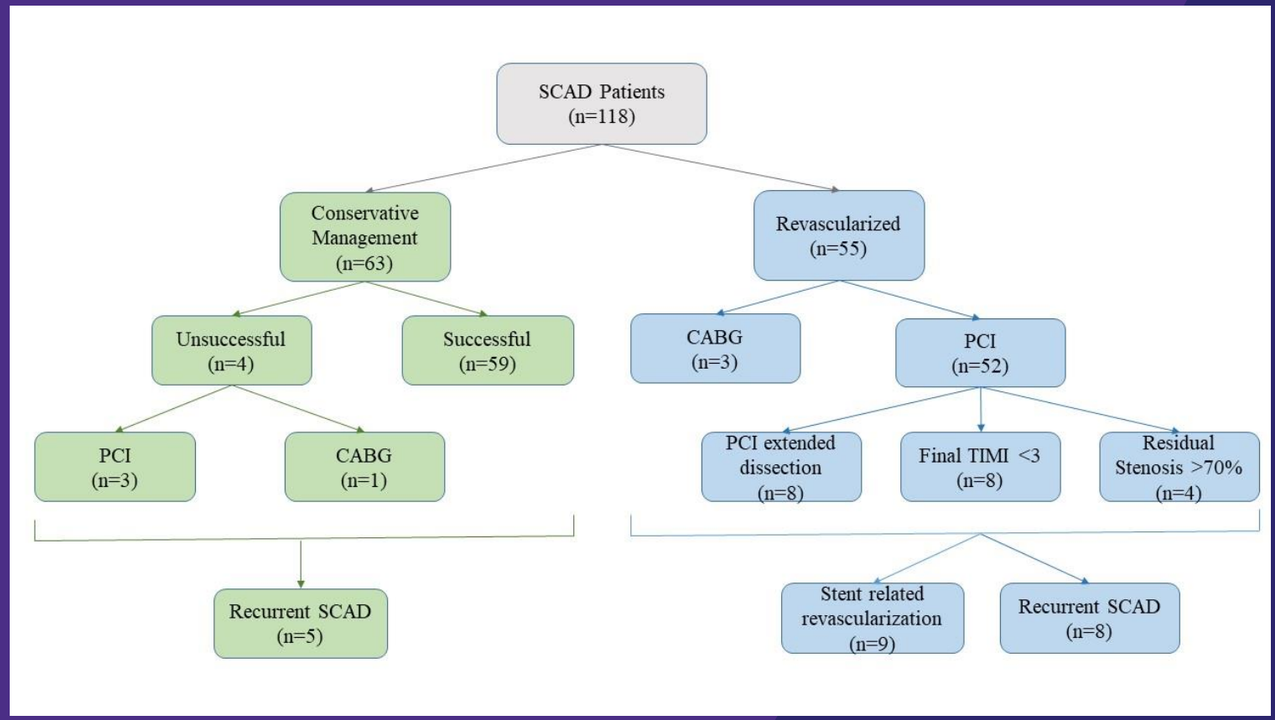
Revascularization Complications at MHI

- Repeat Revascularization: 15 (25.9%)
- Stent Related Complications:
  - PCI extending dissection: 8 (15.4%)
  - Final TIMI <3: 8 (15.4%)
  - Residual stenosis >70%: 4 (7.7%)
  - Stent Thrombosis: 2 (3.4%)
  - Restenosis: 5 (8.6%)
  - Residual Stenosis: 2 (3.4%)
  - Stent Mal-apposition: 1 (1.7%)
- SCAD Recurrence requiring PCI with stenting: 5 (8.6%)
- Multiple Interventions: 2 patients (3.4%)



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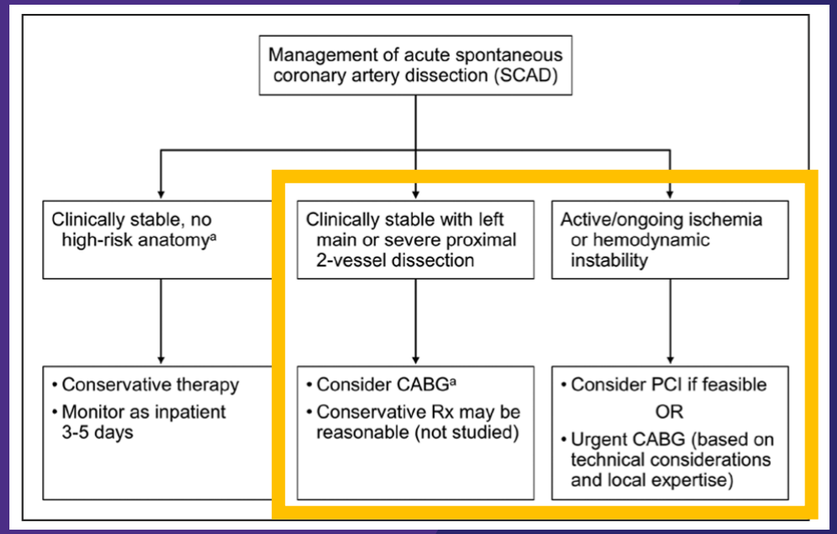
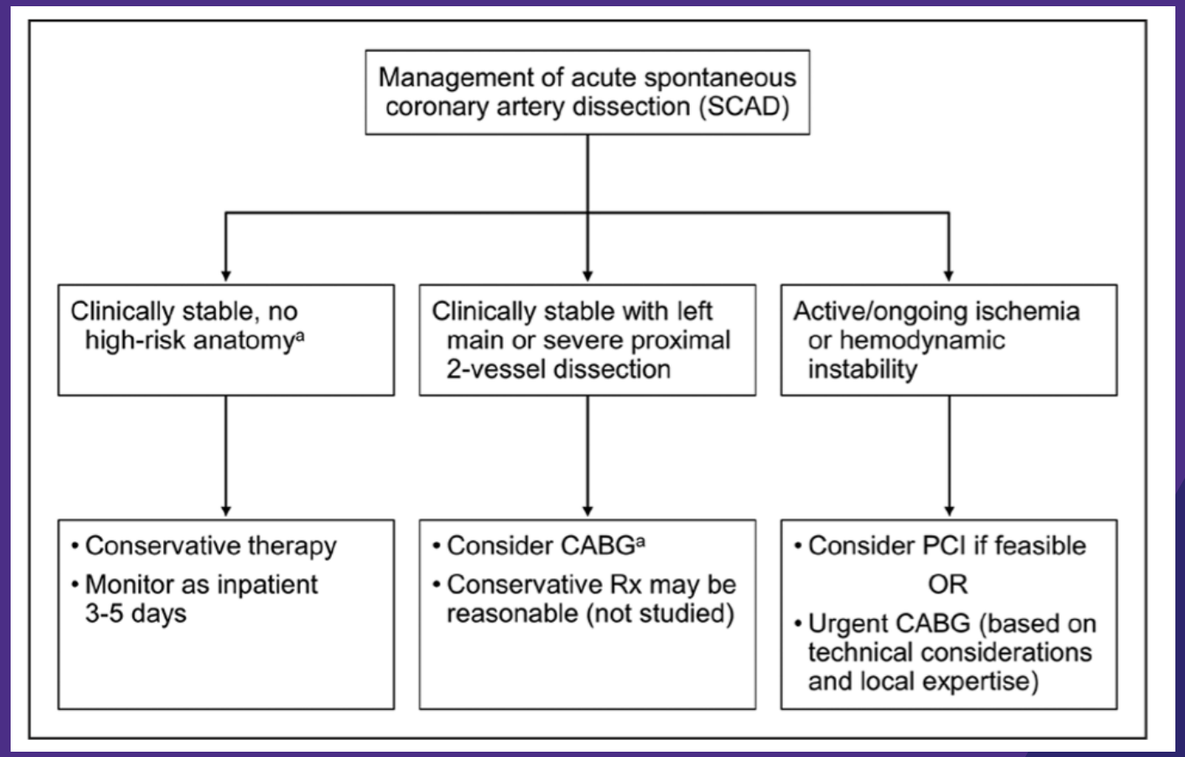
Coronary Artery Bypass Grafting

- Considered Left Main or Proximal Dissections
- High Early Rates of Revascularization
  - 20 patients, 32 of 34 intended targets re-vascularized
- High Rates of Late Graft Failure
  - 11/16 graft failures in 11 of 20 patients imaged during follow-up
- Not protective from recurrent SCAD



Tweet, Marysia S., et al. "Spontaneous coronary artery dissection: revascularization versus conservative therapy." *Circulation: Cardiovascular Interventions* (2014) 7(6): 777-786.

Summary Acute Management



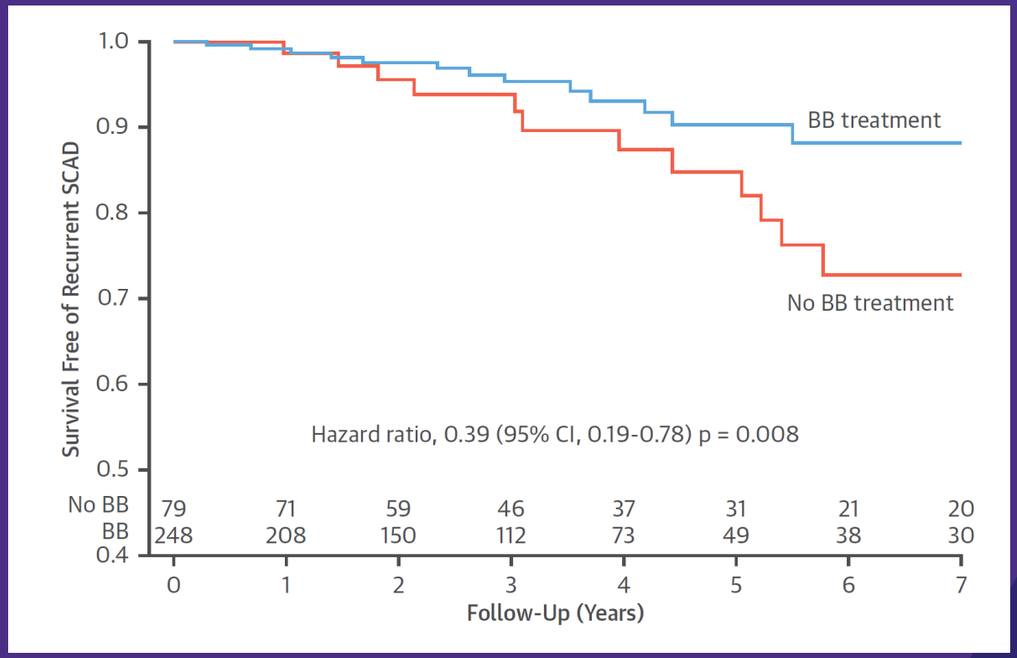
Medical Therapy

- No randomized trials
- Based on expert opinion

Anticoagulation and Antiplatelet Therapy

- Heparin- Discontinue
  - Theoretical risk worsening dissection
- Aspirin- Continue
  - Minimum 1 year, possibly indefinitely
- Dual Antiplatelet Therapy
  - Published series predominantly use clopidogrel
  - Follow standard recommendations for PCI
  - Unclear benefit or duration in use for conservative management
  - Consider 1-3 months in conservatively treated patients

Life Long Beta- Blocker Therapy



Saw et al. J Am Coll Cardiol 2017;70:1148–58.

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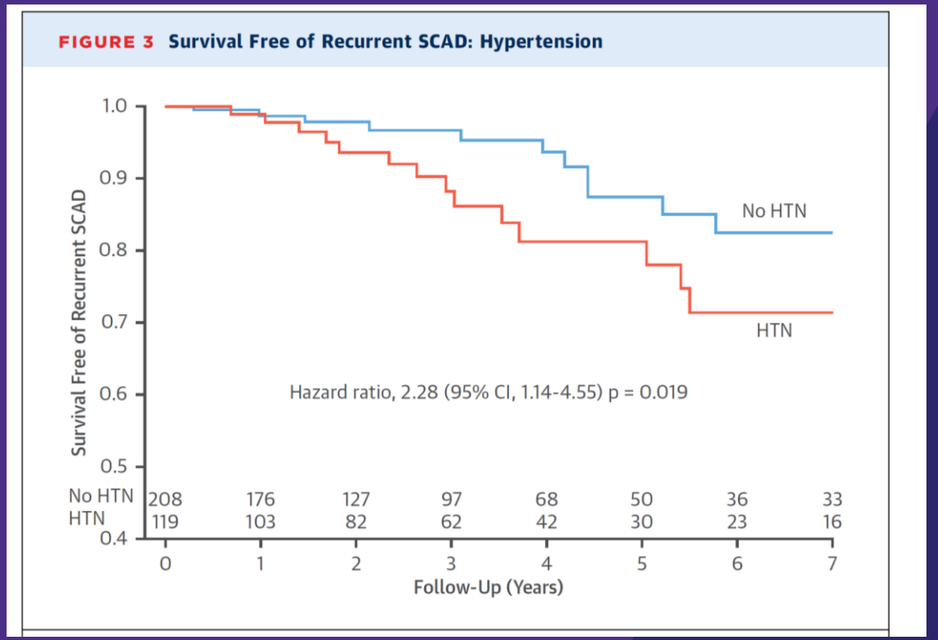
Treat Hypertension

- Ace-I / ARB
  - LV systolic dysfunction
  - Fibromuscular dysplasia
- Calcium Channel Blockers
  - Anti-anginal



Saw et al. J Am Coll Cardiol 2017;70:1148–58.

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Statin Therapy

- Tweet et al in a series of 87 patients found higher recurrence rate with statin use
- Saw et al in series of 327 patients found no association with SCAD recurrence and statin use
- Recommended for primary prevention

Saw et al. J Am Coll Cardiol 2017;70:1148–58.
Tweet et al. *Circulation*. (2012)126(5):579-88.

Antianginal Therapy

- Chest pain after SCAD is common
  - MHI: 50% of non-revasuclarized and 70% of revascularized patients had ED and / or hospital admissions for chest pain
  - Exertional and Non-exertional
  - Mental Stress
    - Anxiety and depression in ~40% of patients following SCAD
  - Menstrual cycle
- Treatment
  - Short and long acting nitrates
  - Calcium channel Blockers
  - Ranolazine
  - Treat associated anxiety and depression

Medial Therapy- Summary

- Discontinue heparin
- Aspirin and beta blocker therapy life long
- Dual antiplatelet individualize recommendation
- ACE-I or ARBs for hypertension or LV systolic dysfunction
- Statins if meet criteria for primary prevention
- Antianginal therapy for post-SCAD chest pain

All SCAD Patients Should Be Referred for Cardiac Rehabilitation

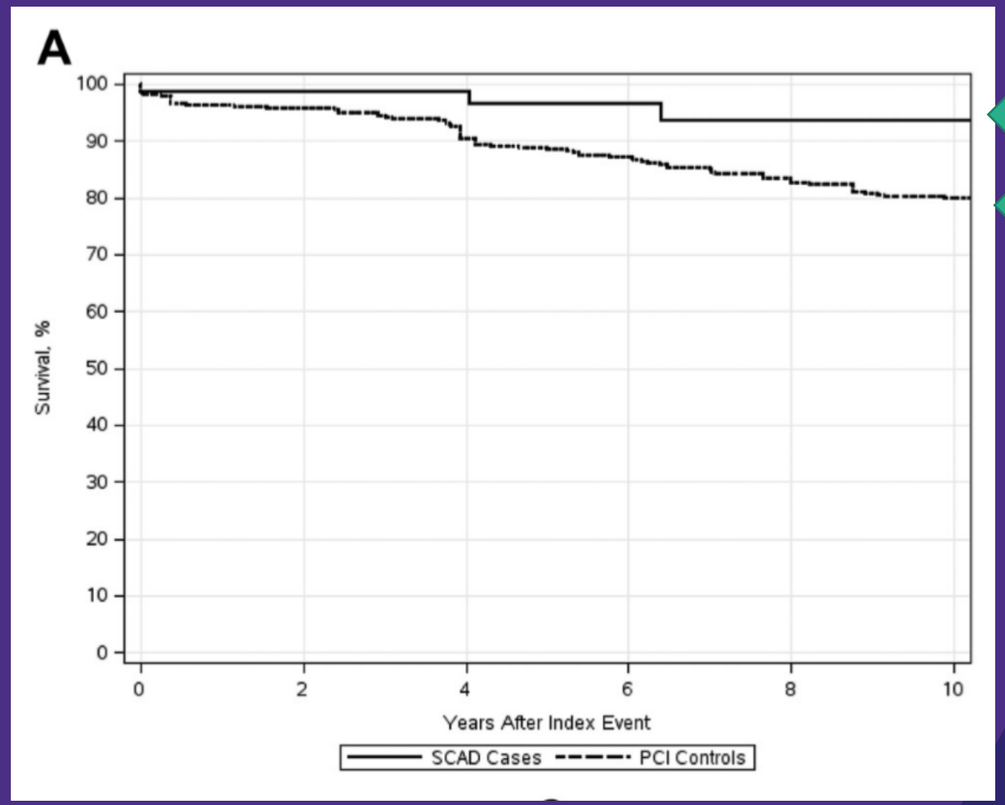
- Starting goals exercise
  - BP max 130/80
  - HR 50-70% of heart rate reserve
  - Free weights: 2-12lbs to start
    - Working up to 20lbs women
    - Working up to 50lbs men
    - Low resistance and high repetition
- Avoid
  - Strain / Valsalva maneuvers
  - High intensity activities
  - High contact sports
  - Pushing to exhaustion
  - Extreme temperatures
  - Abrupt increases in physical activity

Chou et al. J Can J Cardiol 2016;32(4):554–60.

Heart Failure

- All SCAD Patients should have LV EF assessment prior to discharge
- LV EF <50 %
  - Saw et al series of 327 pts: 21.8% at presentation with decreased EF
  - MHI: 19% of non-revascuarlized and 44% of revascularized patients with decreased EF
- Heart Failure Requiring Advanced Therapies at MHI
  - 2 Heart Transplants
  - 1 Left Ventricular Assist Device

Overall Survival Excellent



SCAD

PCI

Tweet et al. *Circulation*. (2012)126(5):579-88.

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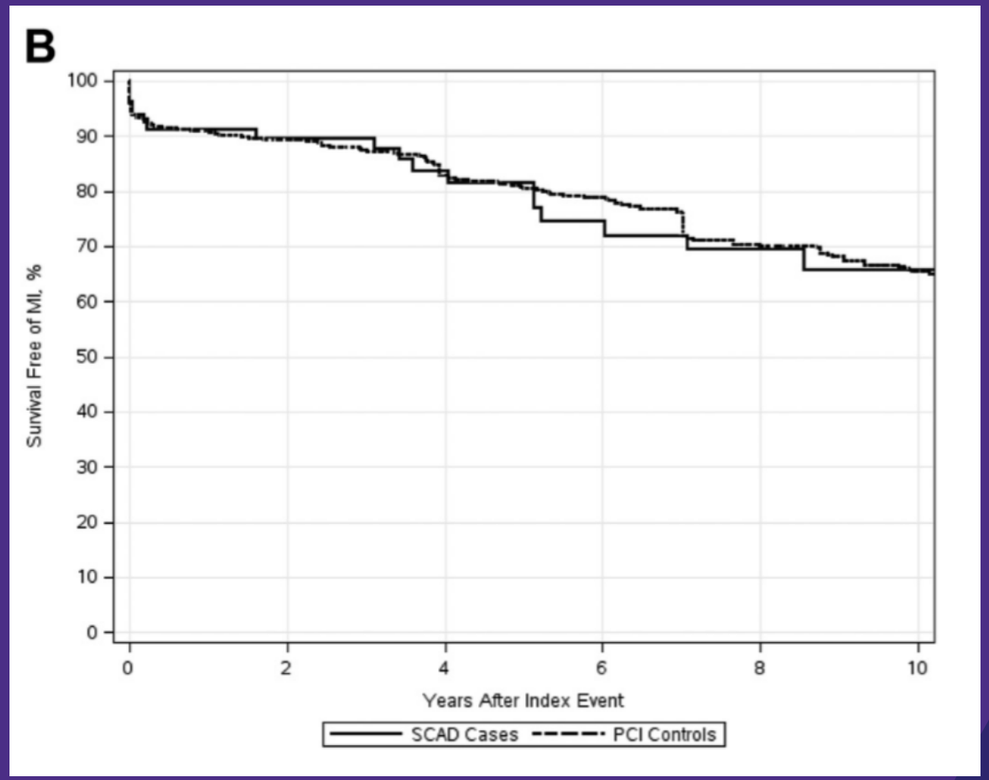
Recurrence is Common



Tweet et al. *Circulation*. (2012)126(5):579-88.

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Pregnancy Associated SCAD

- 1.81 SCAD events per 100,000 pregnancies
- Common etiology of MI among pregnant and post-partum women
- 4% of MHI SCAD Patients
- Higher complication rate
- Acute management same as non-pregnancy SCAD
- Less likely to be associated with Fibromuscular Dysplasia

Pregnancy and Hormone Counseling with SCAD

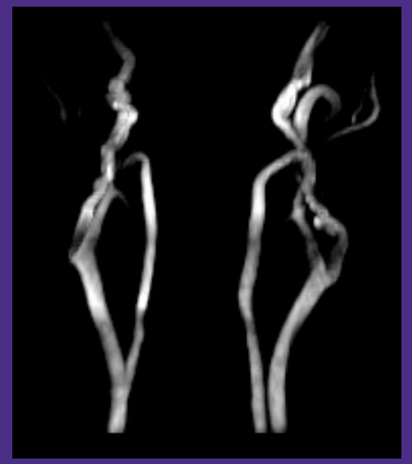
- Pregnancy Counseling
  - Recommend against pregnancy, but data limited support recommendation
  - Preconception counseling if someone desires pregnancy (MHI Cardio-Pregnancy Program)
- Hormone Therapy
  - Non-hormonal contraceptives (IUD with progestin preferred)
  - Avoid Hormone Replacement Therapy
- Medications Contraindicated in pregnancy
  - Statins
  - Atenolol
  - Ace-Inhibitors

Havakuk, Ofer, et al. *Circulation: Cardiovascular Interventions* (2017) 10 (3): e004941.

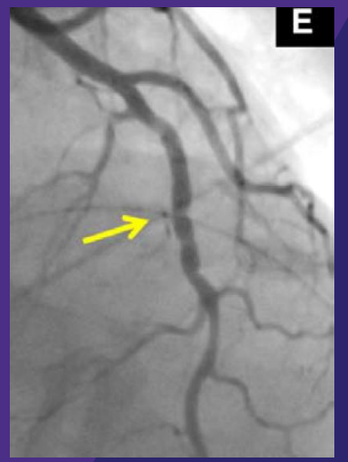
Fibromuscular Dysplasia

- Non-inflammatory non-atherosclerotic disorder that leads to arterial stenosis of small to medium sized vessels
- Aneurysm, tortuosity, and dissections of small to medium sized vessels common

Renal Artery


Carotid Arteries


Femoral Artery



Coronary Artery

Eleid Circ Cardiovasc Interv. 2014;7:656-662.

Fibromuscular Dysplasia Management

- Aspirin 81mg daily for life for thrombosis prevention
- Blood pressure management
  - Ace-I / ARBs for renovascular involvement
  - Beta Blockers for SCAD
  - Beta Blockers, calcium channel blockers, ARBs for Migraines
- Migraines
  - Avoid triptans / vasoconstrictive medications
- Smoking Cessation

Gornik et al, First International Consensus on the diagnosis and management of fibromuscular dysplasia. *Vascular Medicine*. 2019: 24(2) 164-180.

Conclusions

- Diagnosis can be challenging
  - Be aware of prior misdiagnosis
  - Multimodality Imaging
- Acute Management
  - Keep inpatient for minimum 2-3 days
  - Aspirin / Beta Blockers / Clopidogrel
  - Look for Fibromuscular Dysplasia
- Long Term Management
  - Continue Beta Blockers
  - Manage Blood Pressure
  - Pregnancy / Hormone Therapy Counseling
  - Refer to Cardiac Rehabilitation

Thank You.

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