SPONTANEOUS CORONARY ARTERY DISSECTION(SCAD)
Challenges in diagnosis; What's the problem

Ihab Yassin,MD,FEAPCI
Consultant cardiologist
National Heart Institute
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Introduction

- Rare cause of ACS(Non-atherosclerotic)
- 1rst autopsy in 1931 → 42yo woman post SCD
- Underdiagnosed condition
- More prevalent than expected

Definition of SCAD

Non-traumatic and non-iatrogenic separation of the coronary arterial wall by intramural hemorrhage(IMH) creating a false lumen, with or without an intimal tear.

Separation can occur between the intima and media, or between the media and adventitia.

Resulting intramural hematoma compresses the arterial lumen, compromising antegrade blood flow, and can cause myocardial ischemia or infarction.

Prevalence of SCAD

- Among both genders:

  ACS patients→OCT→3-4%

  Stable patients →Elective CA→0.3%

- Among women(<50 yo):

  ACS→8.7%

  STEMI→10.8%

Etiology

I)Predisposing arteriopathy

- **Fibromuscular dysplasia**
- **Pregnancy: history of multiple pregnancy, peri-partum**
- Connective tissue disorder: Marfan's syndrome, Ehler Danlos syndrome, cystic medial necrosis, fibromuscular dysplasia
- Systemic inflammation: systemic lupus erythematosus, Crohn's disease, polyarteritis nodosa, sarcoidosis
- Hormonal therapy
- Coronary artery spasm
- Idiopathic

II)Precipitating stress events

- Intense exercise (aerobic or isometric)
- Intense emotional stress
- Labor & delivery
- Intense Valsalva-type activities (e.g., severe repetitive coughing, retching/vomiting, bowel movement)
- Cocaine, amphetamines, met-amphetamines, beta-HCG

Etiologies in pregnant women

- It is usually in the third trimester and first few weeks postpartum due to:
- 1)Hormonal changes
- 2)Hemodynamic changes
- 3)FMD

Pathophysiology

Mechanism #1

- Intimal tear resulting in blood from the endoluminal space entering the intimal space, creating a false lumen filled with blood.

Mechanism #2

- Due to rupture of the vasa vasorum. When such rupture occurs, blood can pool within the intramural space, creating a false lumen filled with hematoma.

Mechanisms of SCAD

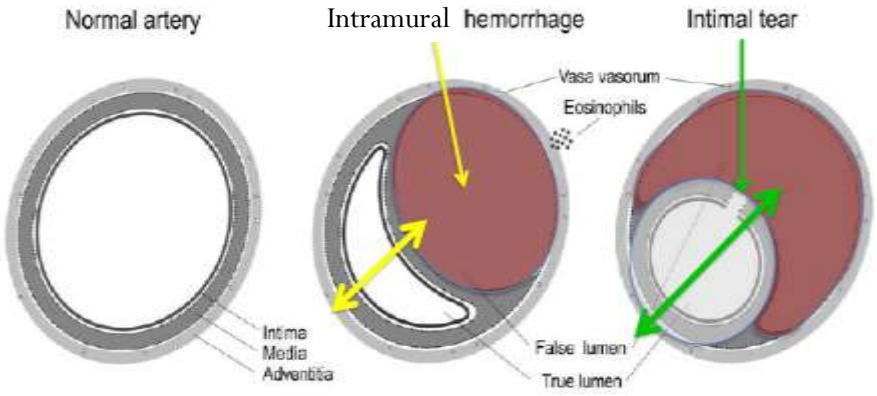


Figure 1. Schematic diagram of the mechanisms of spontaneous coronary artery dissection.

(1) Intimal tear initiating dissection
(2) Spontaneous bleed from vasa vasorum (e.g. increase density from atherosclerosis, eosinophilic degranulation)

Challenges in diagnosis; What is the problem?

History

- **Personal Hx:**
  - Young healthy woman(≤50yo) in childbearing period mostly in late pregnancy or peripartum period.
  - Absence of traditional risk factors
- **c/o**
  - Mild chest pain or atypical symptoms(retching or nausea or vomiting) or SCD
- **Past Hx**
  - FMD
  - Connective tissue disorders
  - Systemic inflammation
  - Precipitating stress events

Challenges in diagnosis ;What's the problem?

Examination

- Either normal or as any patient with ACS or stable IHD

Challenges in diagnosis ;What's the problem?

Investigations

Non imaging

- Non invasive ECG,LABS
  - STEMI in 80-84%
  - NSTEMI in 8-16%
  - Ventricular arrhythmia in 8-14%
  - UA in 4%

Challenges in diagnosis ;What's the problem?

Imaging

- **Non invasive**
  - **Cardiac CT angiography**
- **Limitations**
  - Lower spatial resolution than CA
  - Smaller diameter(<2.5mm) arteries are not visualized
- **Value**
  - Follow-up of healing after SCAD of larger proximal mid coronary arteries

Challenges in diagnosis ;What's the problem?

Investigations

Imaging

- **Invasive**
  - **Coronary angiography**:
- **Limitations**:
  - 2D luminogram only
  - Poor assessment of the arterial wall(IMH)
  - The unfamiliarity of the operators with Type 2 SCAD (most common) and the deceiving type 3 SCAD mimicking atherosclerosis→ **Underdiagnosis of SCAD**

Challenges in diagnosis ;What's the problem?

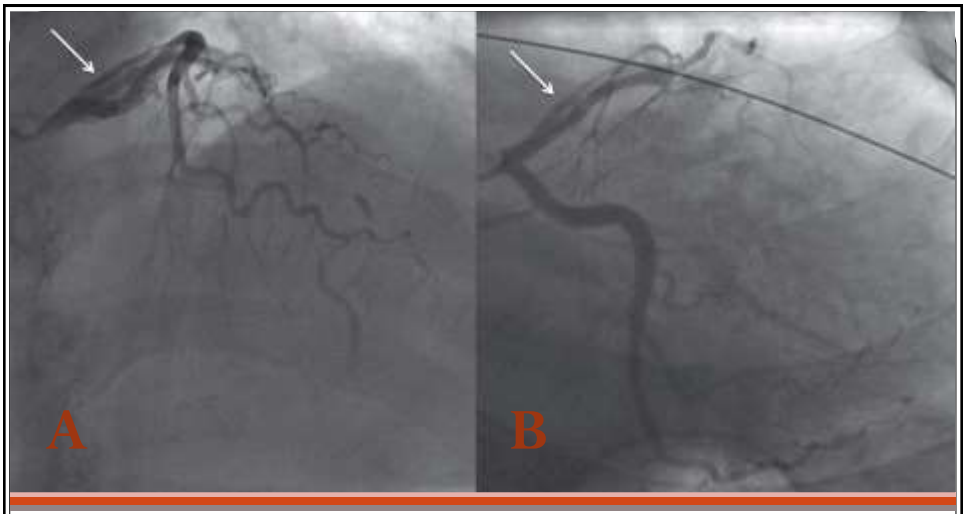
Types of Angiographic SCAD

In the absence of prior coronary intervention or trauma, SCAD is diagnosed when one of the following angiographic criteria is met.

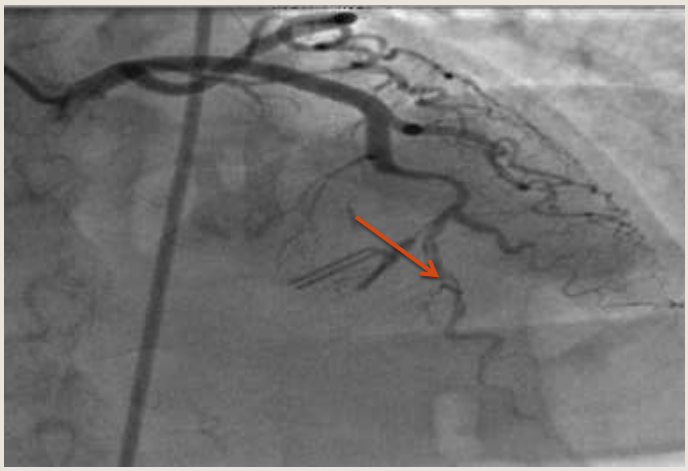
Challenges in diagnosis ;What's the problem?

Type 1 SCAD(33.1%)

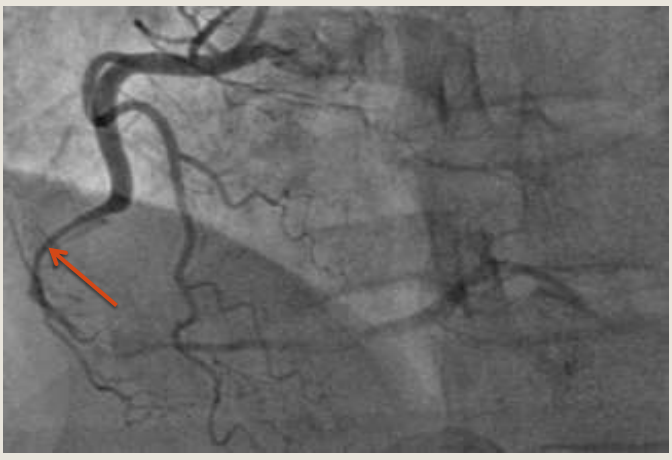
Pathognomonic **contrast dye staining** of arterial wall with multiple radiolucent lumen, with or without the presence of dye hang-up or slow contrast clearing from the lumen.



Type 1 SCAD. (A) Cranial projection showing double-lumen (arrow) with contrast dye hang-up in the proximal LAD, and occluded mid LAD from SCAD; (B) caudal projection showing double-lumen (arrow) of proximal LAD from SCAD. SCAD, spontaneous coronary artery dissection



Type1 SCAD in distal LAD



Type 1 SCAD in distal RCA

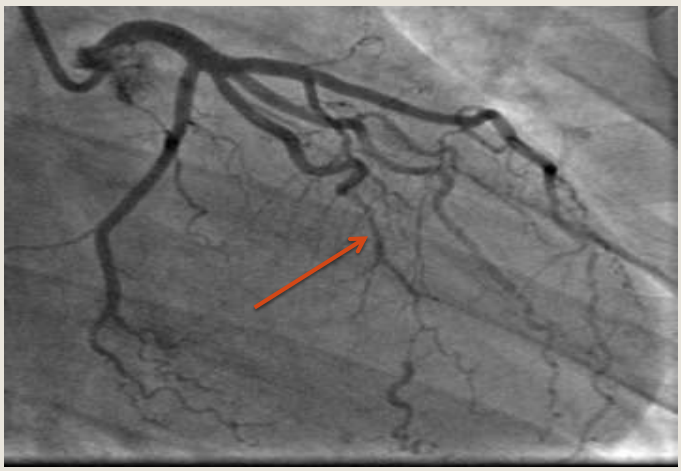
Challenges in diagnosis ;What's the problem?

Type 2 SCAD(62.8%)

Diffuse (typically >20mm) and usually smooth narrowing that can vary in severity from an inconspicuous mild stenosis to complete occlusion.It is **not well appreciated** and is **often missed or misdiagnosed**.

There is an appreciable (often subtle) but **abrupt change in arterial caliber**, with demarcation from normal diameter to diffuse narrowing. Plus:

- (A) There is **no response to intracoronary nitroglycerin**, and there is no atherosclerotic lesions in other coronary arteries
- Or (B) **Repeat coronary angiogram** showing angiographic resolution of the dissected segment; or prior angiogram showing normal artery
- Or (C**) Intracoronary imaging** with OCT (optical coherence tomography) or IVUS (intravascular ultrasound) proving the presence of **intramural hematoma**



Type 2 SCAD. Diffuse narrowing of ramus from mid to apical segment due to intramural hematoma

Type2 SCAD

Type2 SCAD in LCX

Challenges in diagnosis ;What's the problem?

Type 3 SCAD(4.1%)

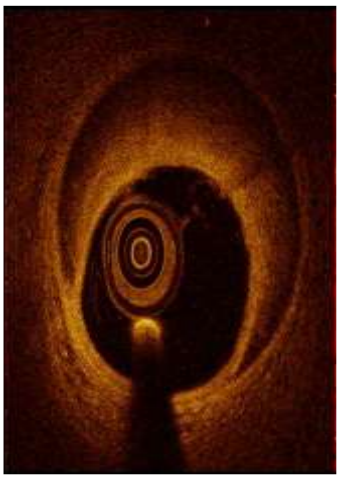
- **the most challenging** as it mimics atherosclerosis with focal or tubular stenosis, it is differentiated using OCT or IVUS proving presence of intramural hematoma.

Type 3 SCAD. Moderate stenosis of the mid LAD .

Combined use of OCT and IVUS in SCAD

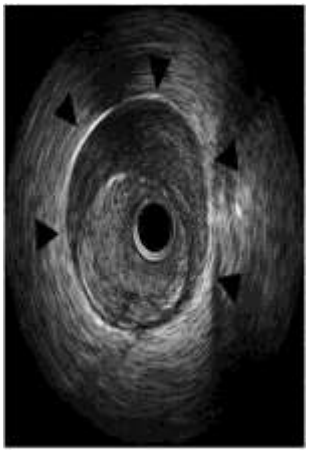
OCT

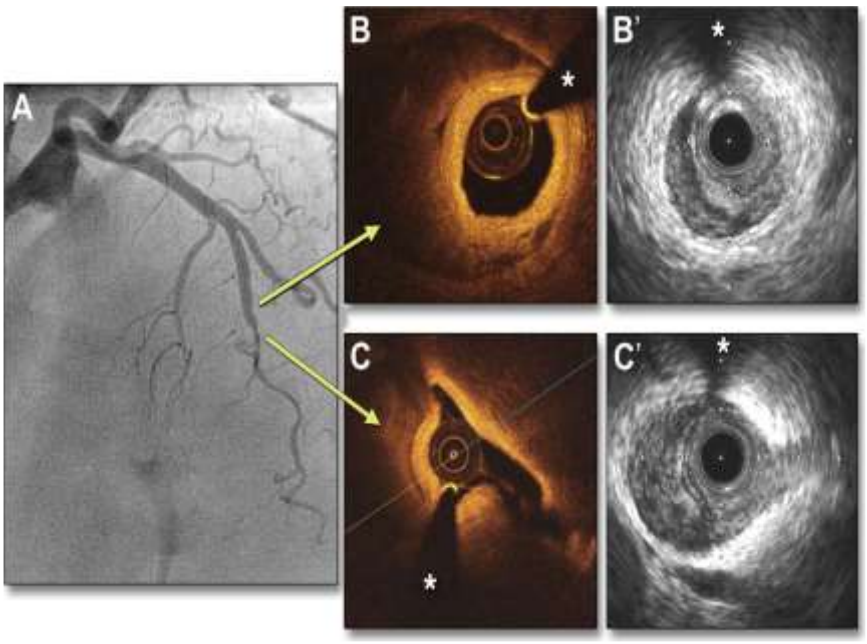
- Better resolution (10-20 microns)
- Clearly delineate true/false lumen, intramural hematoma, intimal tear, intraluminal thrombi
- Poorer penetration (may not see full extension of hematoma in some areas)

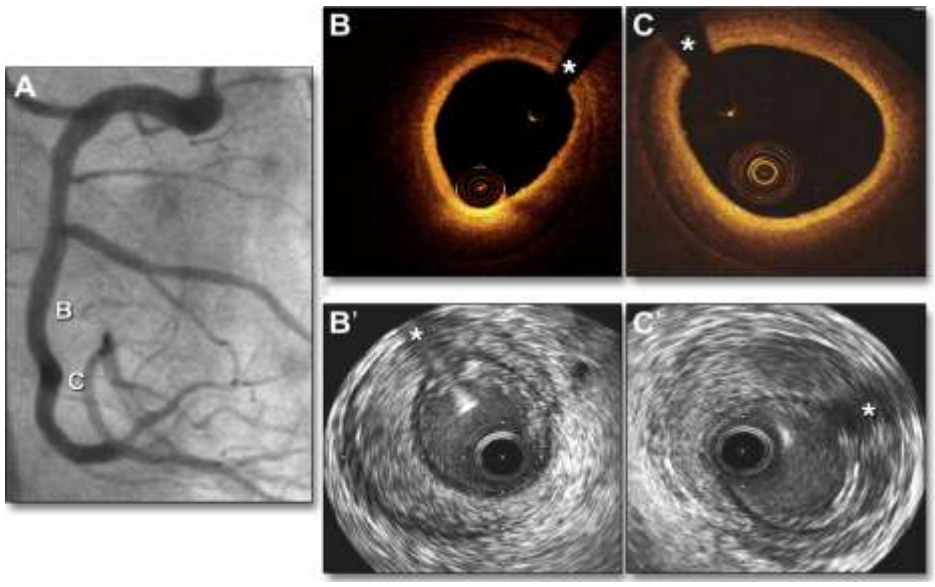


IVUS

- Lower resolution (150-200 microns)
- Can delineate true/false lumen, intramural hematoma, intraluminal thrombi
- May not visualize intimal tear
- Better penetration (can visualize full vessel extent of hematoma)



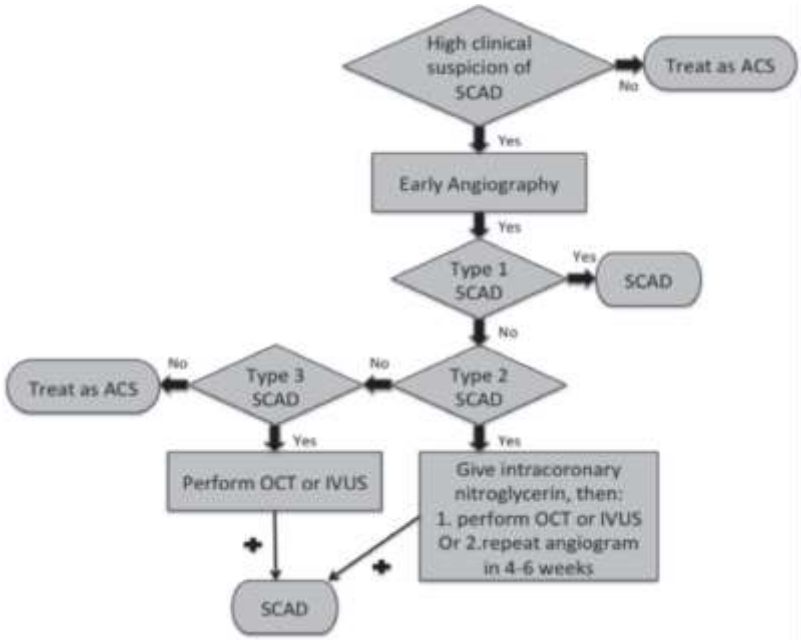


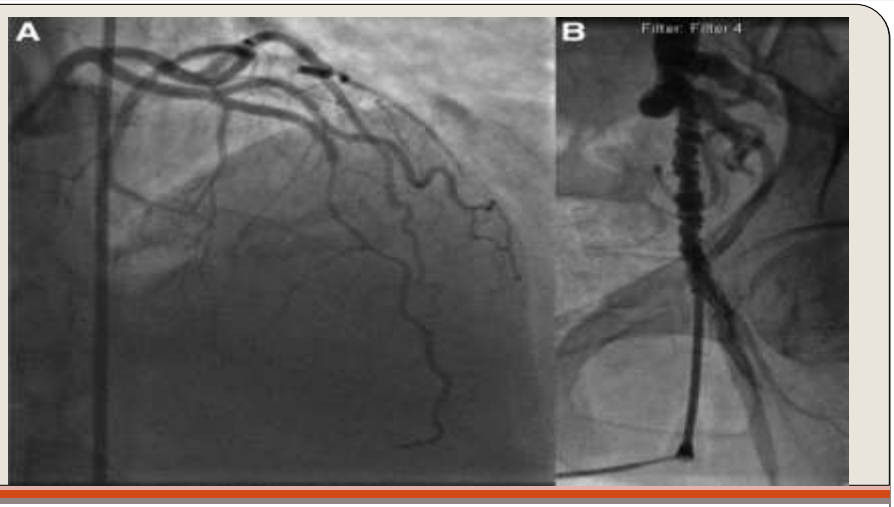


Algorithm for the angiographic diagnosis and confirmation of SCAD

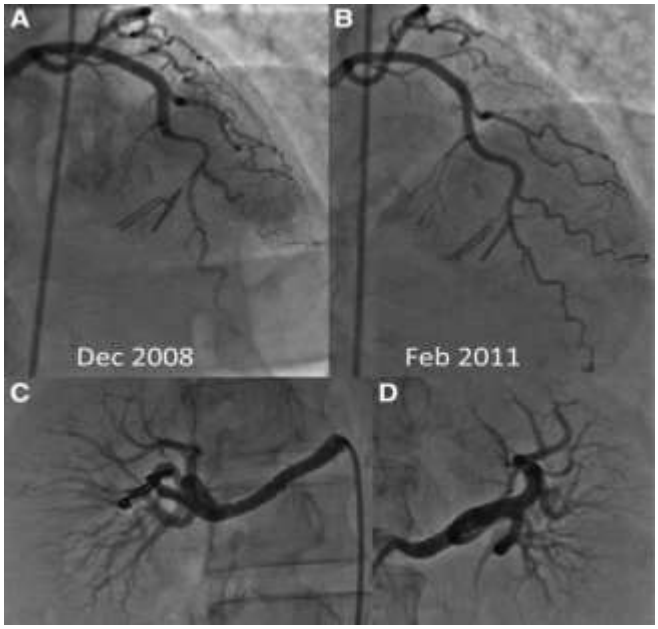
Features that raise clinical index of suspicion for SCAD

1. MI in young women (especially age ≤50)
2. Absence of traditional cardiovascular risk factors
3. Little or no evidence of typical atherosclerotic lesions
3. Peripartum state
4. Presence of fibromuscular dysplasia (FMD)
5. Presence of relevant connective tissue or systemic inflammatory disorders
6. Recent intensive exercise or emotional stress





FMD associated with SCAD in the femoral artery.



Take home message

- SCAD needs a **high index of suspicion** to avoid under or misdiagnosis.
- SCAD needs to be diagnosed **as early as possible** to direct the pathway of treatment.
- The role of **advanced intracoronary imaging** techniques is vital in the diagnosis of SCAD.

Thank You