Cardiology Test Review

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Question 1.(8)

- C; Exercise stress echocardiography

Chest Pain: Diagnosis of CAD

Problem List

- 55-year-old man with HTN
- Chronic chest heaviness +/- induced by exercise +/- relieved by rest (atypical?)
- Associated SOB
- ECG: LVH with repolarization abnormalities (abnormal)

Pre-Test Probability for CAD

Low

Intermediate

High

Chest Pain Evaluation: Pre-Test Probability

Age, Years	Chest Pain Criteria 1. Substernal chest discomfort with characteristic quality and duration 2. Provoked by exertion or emotional stress 3. Relieved promptly by rest or nitroglycerin					
	Nonanginal Chest Pain 1 of 3 Criteria		**Atypical Angina** 2 of 3 Criteria		**Typical Angina** 3 of 3 Criteria	
	Male	Female	Male	Female	Male	Female
30 – 39	4%	2%	34%	12%	76%	26%
40 - 49	13%	3%	51%	22%	87%	55%
50 - 59	20%	7%	65%	33%	93%	73%
60 - 69	27%	14%	72%	51%	94%	86%

LOW
= < 10%

INTERMEDIATE
= 11-89%

HIGH
=>90%

Evaluate for CAD in Patient with LVH

1. STABLE OR UNSTABLE?

- Stable Chronic Angina
- Acute Coronary Syndrome
  - Unstable Angina
  - NSTEMI
  - STEMI

2. PT ABLE TO EXERCISE?

Yes

No

3. BASELINE ECG ?

Normal

Abnormal (BBB, LVH, repol, digoxin)

STRESS
- Exercise
- Vasodilator
- Inotrope

IMAGING
- None (ECG alone)
- Nuclear imaging
- Echocardiogram

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6826912/pdf/10.1177_20406223198848 19.pdf

Question 2.(11)

- D; Start dobutamine

Treat Cardiogenic Shock

Problem List

- 75 yo woman with ischemic cardiomyopathy
- Progressive exertional dyspnea, increasing edema, altered MS, and orthopnea
- Hypotensive, tachycardic, tachypneic, confused, +JVD, +S3, ascites, cool extremities, edema
- Transaminitis, acute kidney injury, hyponatremia, low digoxin level
- EF 20%

1. GET ECG within 10 minutes
2. CBC, CMP, troponin, BNP
3. ABG, lactate
4. Fluids
5. Pressors goal MAP > 65

https://www.ahajournals.org/doi/full/10.1161/JAHA.119.011991

Table 2. Summary of Systemic Vasopressors

Agents	Mechanism	Effect	Indications	Considerations
Phenylephrine	A1 agonist	Vasoconstriction	Various forms of shock	Caution in cardiac dysfunction as it increases afterload
Norepinephrine	A<B agonist	Inotropy, chronotropy, dromotropy, and vasoconstriction	Most common first line agent in shock	Most benefits demonstrated in septic shock
Epinephrine	A≪B agonist	Inotropy, chronotropy, dromotropy, and vasoconstriction	Commonly used as second line agent or first line in anaphylactic shock	Surviving Sepsis Guidelines has most data for epinephrine as second line agent
Dopamine	Dose dependent A, B, and D agonism	Inotropy, dromotropy, chronotropy, and vasoconstriction (at highest doses)	Second line agent in most forms of shock	SOAP II trial demonstrated more incidence of tachy-arrythmias and increased mortality in CS patients when dopamine was used as first line
Vasopressin	V1 agonist	Vasoconstriction	Second line agent in most forms of shock	On or Off dosing, can cause hyponatremia
Dobutamine	B agonist	Inotropy and mild vasodilation	Commonly used in cardiogenic shock	May contribute to hypotension
Levosimendan	Myofilament Ca^{2+} sensitizer and K^{+} channel modifier	Ionotropy and inodilator	Used in acutely decompensated chronic heart failure	Minimal effect on myocardial oxygen consumption

Four Types of Shock

1. HYPOVOLEMIC

- Bleeding externally or internally
- Severe Dehydration
- Massive diarrhea
- Adrenal crisis?

2.CARDIOGENIC

- Acute MI (80%)
- Arrhythmia (tachy or brady)
- Acute cord rupture/acute valve dysfunction/wall rupture

3. DISTRIBUTIVE (Decrease in SVR)

- Sepsis
- Anaphylaxis
- Neurogenic (acute spinal cord)
- Adrenal crisis?

4. OBSTRUCTIVE

- Tamponade
- Pulmonary embolism
- Tension Pneumothorax

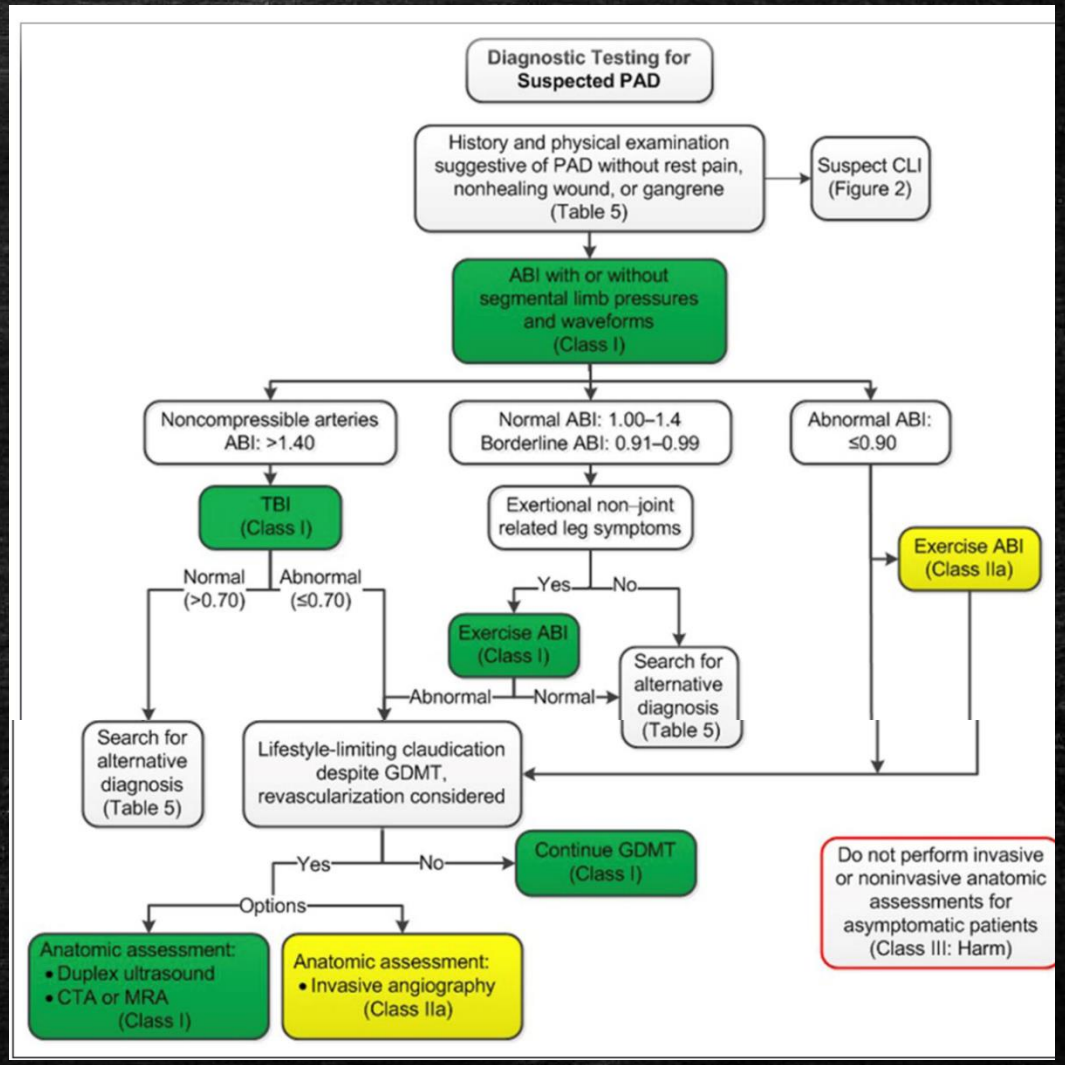
Question 3.(15)

- B; Initiate a supervised exercise program

Diagnosis of Peripheral Artery Disease

Problem List

- 56 yo woman with HTN, HLP, and 50 pk/yr tobacco use
- Aspirin, crestor, cilostazol, amlodipine, losartan
- 6-mo claudication left calf, no rest pain
- Diminished pulses bilat fem and popliteal, decrease pedal pulses L foot
- Ankle-brachial index
  - 0.68 Left
  - 0.86 Right



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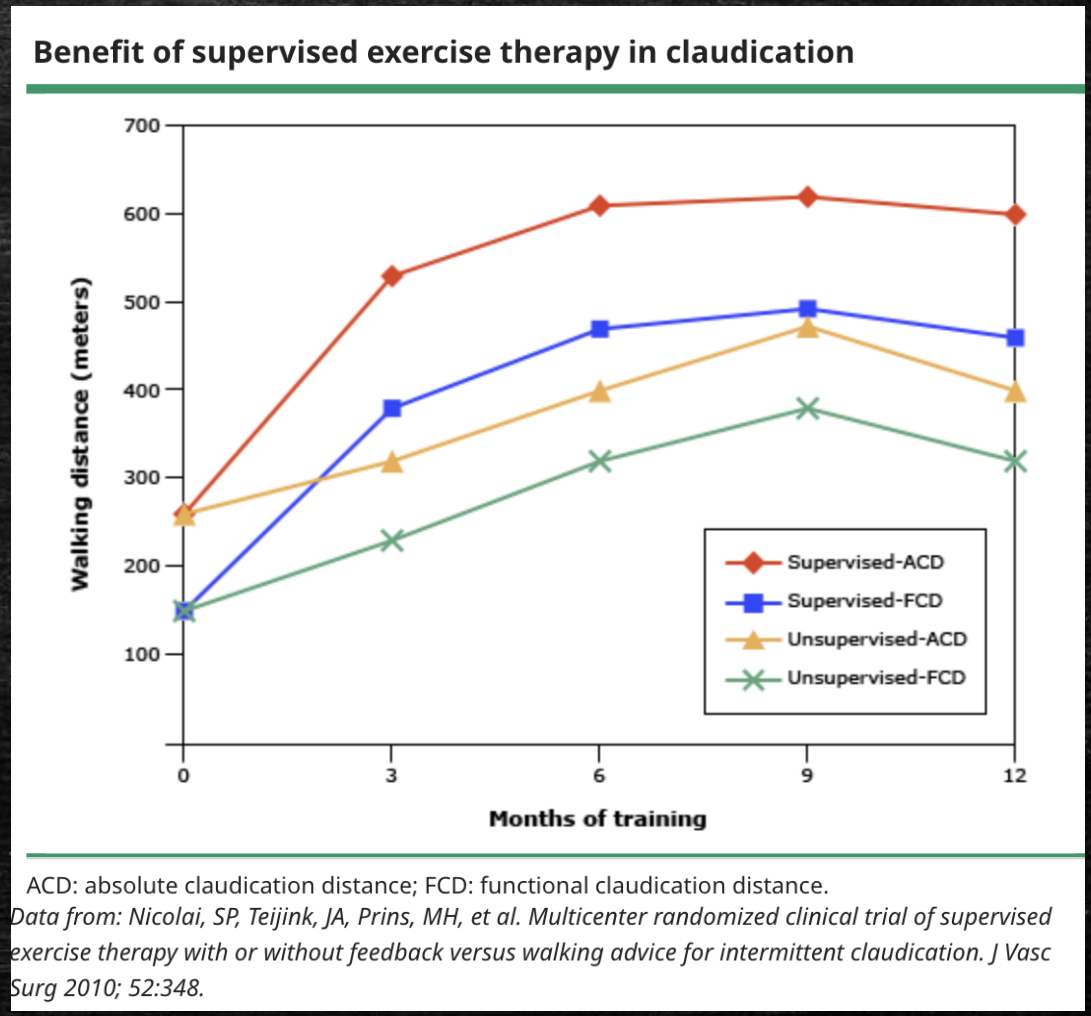
Goal Directed Medical Therapy for PAD

- Supervised Exercise therapy
  - Treadmill 12 weeks, 3x/week/ 60-90 minutes
  - Induce claudication in 3-5 minutes
- Smoking cessation
- Statin therapy
- Antiplatelet therapy
  - Aspirin or Clopidogrel but not both unless another indication
- Cilostazol (or Naftidrofuryl)
  - Phosphodiesterase inhibitor



Question 4.(26)

- E; HIV status

Traditional vs Nontraditional Risk Factors for CAD

Traditional Risk Factors for CAD

- Age/Sex
- Hypertension
- Cigarette smoking
- Diabetes mellitus
- Hyperlipidemia
- Premature family history (M <55, F< 65)
- Obesity

- Pooled Cohort Equation 10 yr. risk:
  - Low Risk < 5%
  - Intermediate Risk 5-7.5%
  - High risk > 7.5%

Risk-enhancing factors:

- Metabolic syndrome
- CKD (GFR 15-59)
- Chronic Inflammatory conditions
  - Rheumatic disease (RA, lupus)
  - HIV disease
- Premature menopause (<40) or pre-eclampsia
- High-risk race/ethnicity (South Asian)
- Biomarkers CRP >2 mg/L and ABI < 0.9

Question 5.(27)

- C; Exercise electrocardiography

Diagnosis of CAD in Women

Problem List

- 52 yo woman with HTN, HLP
- 6 weeks CP with exercise, emotion, and relieved with rest
- HCTZ, lisinopril, atorvastatin
- Normal PE
- Normal ECG

- A study of 10,689 patients who presented to emergency departments with symptoms suggestive of ACS, women who presented with evidence of myocardial infarction were more likely to be discharged home without hospitalization compared with men (3.4 versus 1.4 percent, p = 0.05)*
- Women below the age of 55 had a far greater risk of being discharged home with evidence of ACS compared with young men (OR 6.7, 95% CI 1.4-32.5; p = 0.02).+

*Missed diagnoses of acute cardiac ischemia in the emergency department.AUPope JH, Aufderheide TP, Ruthazer R, Woolard RH, Feldman JA, Beshansky JR, Griffith JL, Selker HP SON Engl J Med. 2000;342(16):1163.

+ Sex-based differences in early mortality after myocardial infarction. National Registry of Myocardial Infarction 2 Participants.AUVaccarino V, Parsons L, Every NR, Barron HV, Krumholz HM SON Engl J Med. 1999;341(4):217.

Chest Pain Evaluation: Pre-Test Probability

Age, Years	Chest Pain Criteria 1. Substernal chest discomfort with characteristic quality and duration 2. Provoked by exertion or emotional stress 3. Relieved promptly by rest or nitroglycerin					
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INTERMEDIATE
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=>90%

Evaluate for CAD in a Woman

(Consider hormone status, family hx, diabetes, smoking…)

1. STABLE OR UNSTABLE?

- Stable Chronic Angina
- Acute Coronary Syndrome
  - Unstable Angina
  - NSTEMI
  - STEMI

2. PT ABLE TO EXERCISE?

Yes

No

3. BASELINE ECG ?

Normal

Abnormal (BBB, LVH, repol, digoxin)

STRESS

- Exercise
- Vasodilator
- Inotrope

IMAGING

- None (ECG Alone)
- Nuclear imaging
- Echocardiogram

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6826912/pdf/10.1177_20406223198848l9.pdf

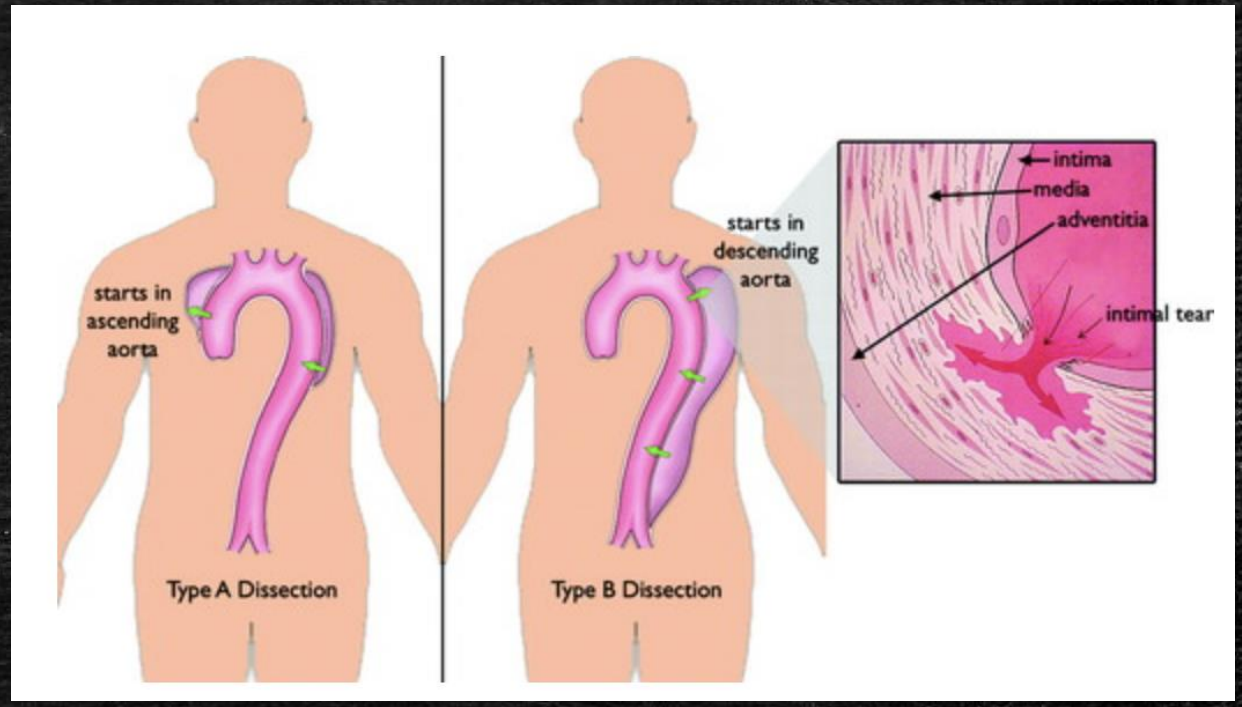
Question 6. (30)

- C; Medical therapy

Treat Acute Descending (Type B) Aortic Dissection (without cardiogenic shock)

Problem List:

- 64 yo woman with HLP
- Acute sharp, "tearing" chest and back pain
- Hypertensive, BP equal in both arms
- CT angiography descending thoracic aortic aneurysm 6.8 cm and dissection left subclavian to above renal arteries



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Treat Acute Descending (Type B) Aortic Dissection (without cardiogenic shock)

- Acute lowering of the BP with IV B-blocker therapy to systolic goal of 120 mm Hg or less
- Vasodilators can be used AFTER B-blocker
- Pain management

Table. Genetic Conditions Associated With Aortic Dissection

Marfan syndrome	A connective tissue disorder caused by a defect in a gene called *FBN1*. Patients with Marfan syndrome are often very tall and thin; may have long fingers, toes, arms, and legs; chest wall deformities; scoliosis; mitral valve prolapse; and eye problems (lens dislocation, myopia, or retinal detachment).
Bicuspid aortic valve	Congenital condition affecting about 1% of the general population that may occur in multiple family members. Patients with bicuspid aortic valves often have enlarged ascending aortas and are at risk for aortic dissection (5 to 10 times higher risk than the general population).
Loeys-Dietz aneurysm syndrome	Genetic disorder due to a mutation in *TGFBR1* or *TFGBR2* leading to arterial tortuosity, wide-set eyes (hypertelerism), cleft lip/palate, and aortic dissections and aneurysms involving branch vessels.
Familial thoracic aortic aneurysm/dissection	Multiple conditions involving aneurysms and dissections that occur in several family members. Currently associated with mutations in various genes including *TGFBR1* and *TGFBR2*, *FBN1, MYH11*, and *ACTA 2*.
Vascular Ehlers-Danlos syndrome (type 4)	Genetic disorder that results in a defect in the gene *COL3A1* leading to abnormal collagen synthesis. Patients with vascular Ehlers-Danlos syndrome have flexible fingers, hyperlucent skin, and varicose veins and are at risk for sudden death from spontaneous arterial dissection/rupture and intestinal or uterine rupture.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5831732/pdf/40560_2018_Article_287.pdf

Thoracic Endovascular Aortic Repair(TEVAR) for Complicated Type B Aortic Dissection

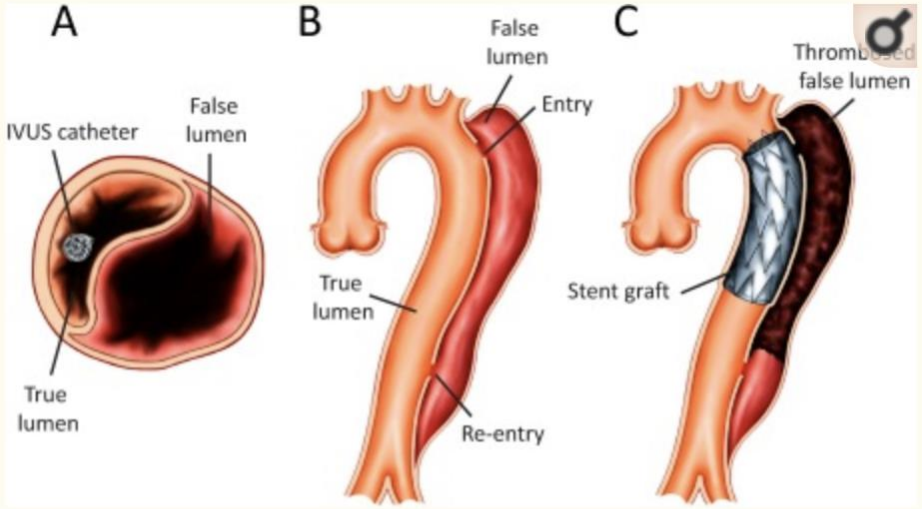

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Fig. 1 Schematic drawings of TEVAR procedure of type B aortic dissection.

A: Confirmation of IVUS catheter being inside the true lumen. **B**: Primary intimal tear located at the descending aorta. **C**: Stent graft coverage of the primary intimal tear. TEVAR: thoracic endovascular aortic repair; IVUS: intravascular ultrasound

- Complicated = descending aortic aneurysm diameter > 6 cm or end-organ damage
- TEVAR complications include stroke, spinal ischemia, and aortic graft leaks
- Open surgical repair is not recommended for uncomplicated type B dissections due to risk of paraplegia and mortality

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6326065/

Question 7. (32)

- D; Ticagrelor-mediated side effect

Antiplatelet Therapies for ACS

Problem List

- 52 yo woman s/p NSTEMI and DES placement, RCA 3 weeks ago
- Shortness of breath since discharge
- Aspirin, ticagrelor, lisinopril, metoprolol, atorvastatin
- Normal exam, CXR, ECG unchanged

P2Y12 inhibitors

- Clopidogrel: Plavix
- Ticagrelor: Brilinta
- Prasugrel: Effient
- Cangrelor: Kengreal

Ticagrelor

- Dyspnea 14-21% often goes away within 1 wk
- Maintenance aspirin should be LOW dose only

Prasugrel:

- Contraindicated in patients with prior TIA/stroke or age ≥ 75 yo

Table 9.

$P2Y_{12}$ Inhibitors Used in the Treatment of Patients with Coronary Artery Disease

Drug	Indications	Loading Dose	Maintenance Dose	Adverse Effects	Contraindications
Clopidogrel	Stable CAD treated with PCI ACS	300-600 mg	75 mg/d	Increased bleeding risk	Known allergy to the drug
Ticagrelor	ACS	180 mg	90 mg twice daily[a]	Increased bleeding risk, dyspnea	Known allergy to the drug
Prasugrel	ACS treated with PCI[b]	60 mg	10 mg/d[c]	Increased bleeding risk	Known allergy to the drug, prior transient ischemic attack/stroke, age ≥75 y

ACS = acute coronary syndrome; CAD = coronary artery disease; PCI = percutaneous coronary intervention.

[a]Ticagrelor should be used with aspirin, 81 mg/d.

[b]Prasugrel should not be loaded "upstream" (before catheterization).

[c]Prasugrel, 5 mg/d, should be considered for those weighing less than 60 kg (132 lb) or at moderate to high risk for bleeding (e.g., patients with significant kidney function impairment).

Question 8. (33)

- D; Takotsubo cardiomyopathy

Diagnose Takotsubo cardiomyopathy

Problem List

- 68 yo woman previously healthy
- Acute dyspnea, palpitations, and chest pain after stressful event
- Hypertensive, S3 on exam
- ECG consistent with STEMI
- Normal coronaries on cath
- Left ventriculography shows apical ballooning on systole

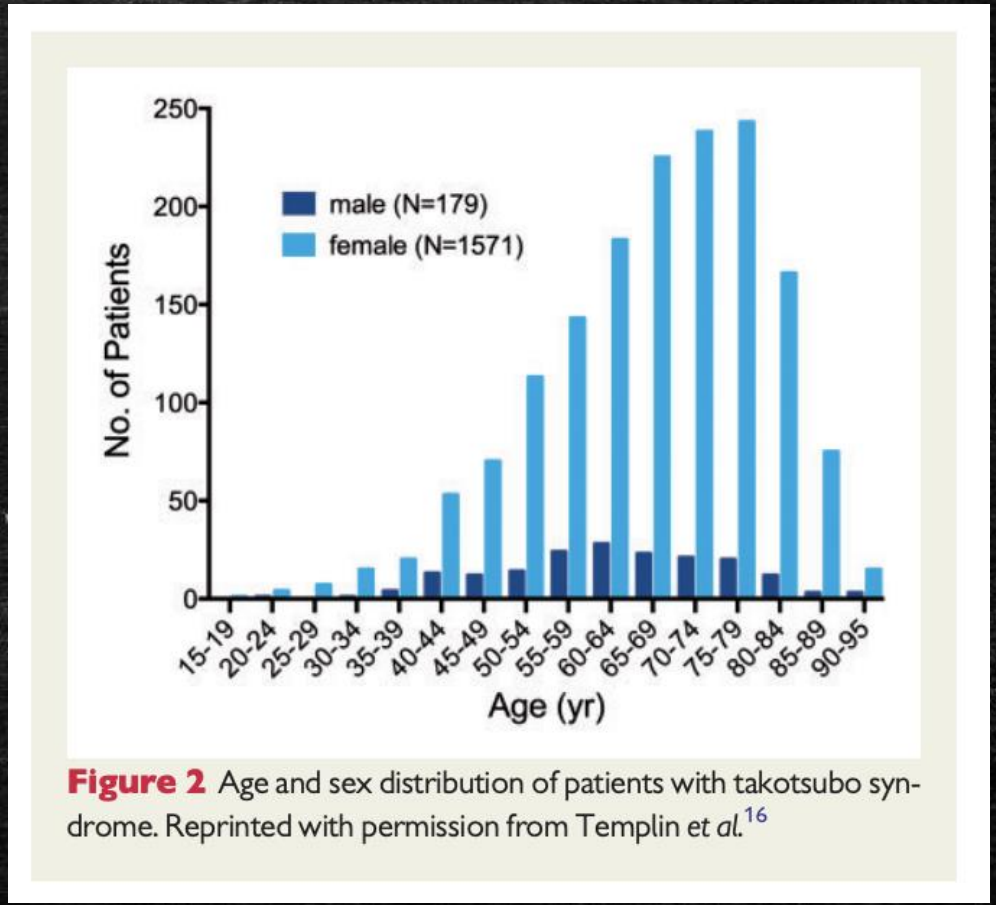

Figure 2 Age and sex distribution of patients with takotsubo syndrome. Reprinted with permission from Templin *et al.*[16]

https://academic.oup.com/eurheartj/article/39/22/2032/5025412

Diagnose Takotsubo Cardiomyopathy

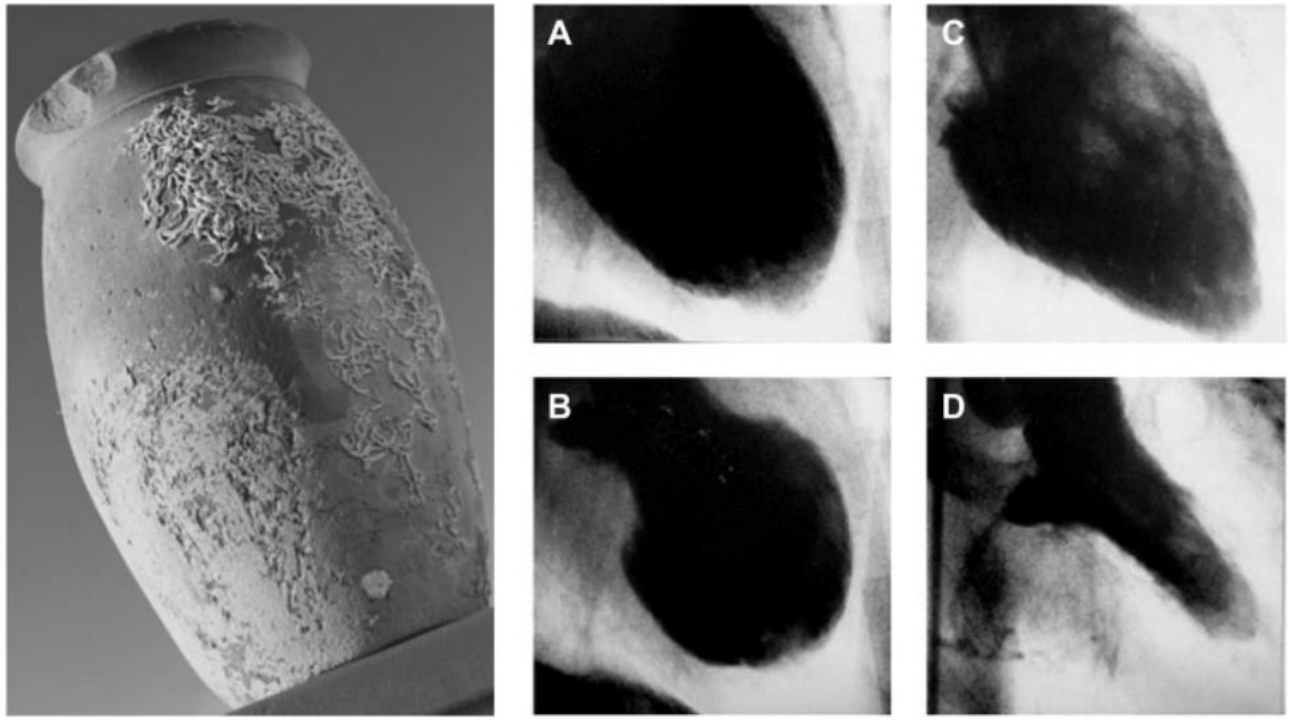

Figure 1 Historical Japanese octopus trap (left). Courtesy of Dr Templin, University Hospital Zurich, Zurich, Switzerland. Left ventriculogram of the first reported case of takotsubo syndrome. Diastole (*A*) and systole (*B*) during the acute phase of takotsubo syndrome. Recovery of left ventricular wall motion abnormality two weeks after the event (*C* and *D*). Courtesy of Dr Dote, Hiroshima City Asa Hospital, Hiroshima, Japan.

- Elderly woman
- Stressful event
- Acute chest pain, palpitations, dyspnea
- ST elevation
- Elevated biomarkers
- Normal coronaries (non-obstructive)

Question 9. (35)

- C: Coronary CT angiography

Evaluate for CAD with CT angiography in a patient with COPD

Problem List

- 60 yo man with DM 2 with neuropathy, HTN, HLP, and moderate-severe COPD
- 2-day CP and DOE
- Vitals normal x tachypneic, expiratory wheezing, distant heart sounds, no edema
- Serial troponins negative
- ECG with LVH and repolarization abnormalities

Pre-Test Probability for CAD

Low

Intermediate

High

Chest Pain Evaluation: Pre-Test Probability

Age, Years	Chest Pain Criteria 1. Substernal chest discomfort with characteristic quality and duration 2. Provoked by exertion or emotional stress 3. Relieved promptly by rest or nitroglycerin					
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INTERMEDIATE
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HIGH
=>90%

Evaluate for CAD in Patient with COPD

1. STABLE OR UNSTABLE?

- Stable Chronic Angina
- Acute Coronary Syndrome
  - Unstable Angina
  - NSTEMI
  - STEMI

2. PT ABLE TO EXERCISE?

Yes

No

3. BASELINE ECG ?

Normal

Abnormal (BBB, LVH, repol, digoxin)

STRESS

- Exercise (nope)
- Vasodilator (contraindicated)
- Inotrope

IMAGING

- ECG alone
- Nuclear imaging
- Echocardiogram
- CT angiogram! (No stress)

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6826912/pdf/10.1177_20406223198848 19.pdf

PROMISE TRIAL:Prospective Multicenter Imaging Study for the Evaluation of Chest Pain

- Randomized 10,003 patients with symptoms and intermediate CAD pre-test probability to anatomic (CTA) vs functional test (exercise ECG (10%), stress ECHO (22%), or nuclear stress test (68%).
- Primary endpoints: All cause mortality, MI, hospitalization for USA, and cardiac complication
- No difference in primary outcome between anatomic and functional testing (3.3% vs 3.0%
- Although more patients in the CTA group underwent invasive catheterization within 90 days, CTA was associated with lower rates of non-obstructive CAD on angiography (i.e., higher diagnostic yield) than the functional group (3.4% vs. 4.3%, P = 0.022).
- Small differences in radiation exposure were found, with median radiation exposure overall lower in the CTA group (10.0 mSv vs. 11.3 mSv), but with a higher mean exposure in the CTA group (12.0 mSv vs. 10.1 mSv).
- Although the initial cost of a diagnostic CTA was lower than functional tests testing, the cumulative cost of a CTA, resulted in a small, non-significant increase in costs (<$500) compared to functional testing over a median of two-year follow-up.

https://www.acc.org/latest-in-cardiology/articles/2015/07/27/10/58/the-promise-trial-the-cta-perspective

Question 10. (40)

- A; Advise the patient that he should not play basketball

Evaluate the Eligibility of a patient with HCM for participation in sports

Problem List

- 18 yo man on basketball scholarship to college; no symptoms or family hx
- Brisk upstroke; 3/6 systolic crescendo-decrescendo murmur ; decreases with squat, increases with standing
- ECG; LVH+ repol abnormality
- Echo: asymmetrical hypertrophy of septum 18 mm; anterior mitral motion, LVOT gradient 30 mm Hg

Hypertrophic (Obstructive) Cardiomyopathy (HCM or HOCM)

- Autosomal dominant (1:500)
- Asymmetric septal hypertrophy and myocyte disarray
- Asymptomatic to exertional syncope to sudden death (annual incidence 1-2%)
- Dynamic LV outlet obstruction AND arrhythmias

Maneuvers that WORSEN obstruction and make the MURMUR LOUDER

HOCM	Preload	Contractility	Afterload
WORSENS OBSTRUCTION	↓	↑	↓
Valsalva	↓		
Isometric Hand Grip			↑
Squatting	↑		
Standing	↓		

DRUGS CONTRAINDICATED IN HOCM:

- DIURETICS
- INOTROPES
- ARTERIAL VASODILATORS
- VENOUS VASODILATORS

DRUG INDICATED: B-BLOCKERS

HOCM Workup & Therapy

Workup

- Doppler echo for gradient
- Cardiac MR
- 24-hour ambulatory ECG
- BP response to exercise*
- Alcohol ablation/surgical myotomy for mod/severe obstruction refractory to med therapy or syncope not due to arrhythmia

ICD for Primary Prevention

1. Sudden death in first-degree relative
2. Maximum LV thickness $\geq$ 30 mm
3. Recent, unexplained syncope
4. NSVT $\geq$ 3 beats
5. Abnormal blood pressure response to exercise

Question 11. (46)

- D; Warfarin and aspirin

Anticoagulation for Prosthetic Heart Valves

Table 3 Antithrombotic Therapy Recommendations in Patients With Valve Replacement(s)

Valve Replacement	Antiplatelet Agents	Vitamin K Antagonist
Bioprosthetic Valve	ASA 75 mg-100 mg daily is reasonable if AVR or MVR	AVR or MVR: INR goal 2-3 is reasonable for first 3 months if there is low risk of bleeding
Mechanical Valve	ASA 75 mg-100 mg daily may be considered if low bleeding risk	AVR if no VTE risk factors[a]: INR goal 2-3 AVR if presence of VTE risk factors[a]: INR goal 2.5-3.5 MVR: INR goal 2.5-3.5
TAVR	ASA 75 mg-100 mg daily indefinitely + clopidogrel 75 mg daily for first 3-6 months may be reasonable	If clopidogrel is not used, INR goal 2-3 for first 3-6 months may be considered

[a] *Atrial fibrillation, previous thromboembolism, left ventricular dysfunction, or hypercoagulable conditions.*

ASA: aspirin; AVR: aortic valve replacement; INR: international normalized ratio; MVR: mitral valve replacement; TAVR: transcatheter aortic valve replacement; VTE: venous thromboembolism. Source: References 5, 8.

Adding low dose aspirin to warfarin in patients at low risk of bleeding decreased mortality from vascular causes and major systemic embolism from 8.5% per year to 1.9% per year.

https://www.uspharmacist.com/article/antithrombotic-therapy-in-patients-with-valvular-heart-disease

Otto CM, Nishimura RA, Bonow RO, et al. 2020 AHA/ACC guideline for the management of patients with valvular heart disease: executive summary: a report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. *Circulation*. December 17, 2020.

Question 12. (51)

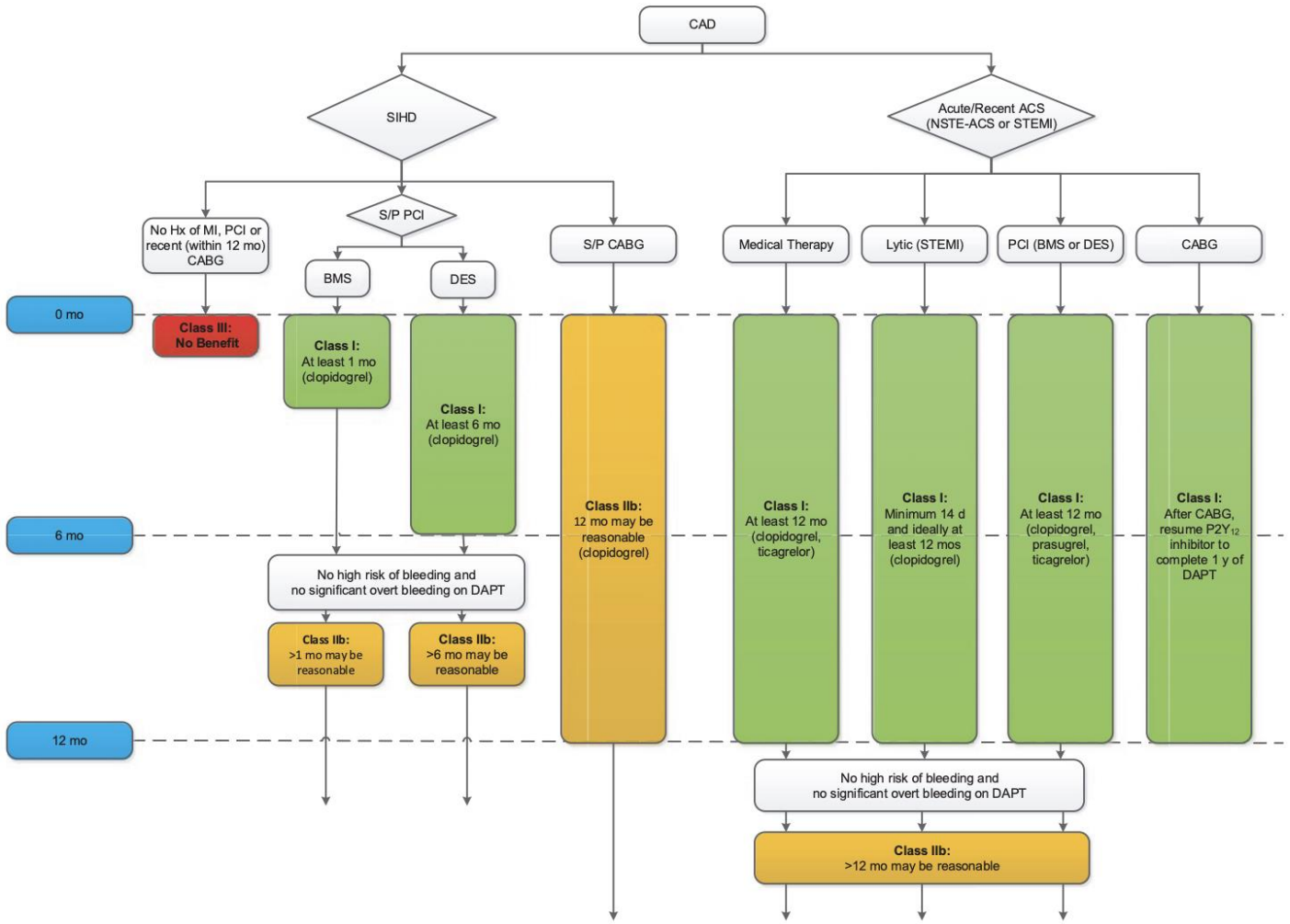
- B; Discontinue clopidogrel in 5 months

Manage DAPT in a patient with chronic stable angina (NOT ACS) treated with a DES

Problem List

- 81 yo woman with angina (NOT ACS) treated with DES 1 month ago and started on DAPT with aspirin and clopidogrel
- Hx of PUD, CKD_3, HLD, HTN

FIGURE 1 Master Treatment Algorithm for Duration of $P2Y_{12}$ Inhibitor Therapy in Patients With CAD Treated With DAPT



https://www.acc.org/~/media/Non-Clinical/Files-PDFs-Excel-MS-Word-etc/Tools%20and%20Practice%20Support/Quality%20Programs/Anticoag-10-14/DAPT/1%20Levine%202016%20DAPT%20Guidelines.pdf?la=en

Question 13. (54)

- C; Implantable cardioverter-defibrillator placement

Prevent sudden cardiac death in a patient with nonischemic cardiomyopathy

Problem List

- 51 yo man with nonischemic cardiomyopathy
- Witnessed sudden LOC with shaking, no prodromal symptoms, no post-ictal symptoms
- Class II NYHA, on metoprolol and lisinopril for 9 months
- Normal cardiopulmonary exam except some ectopy
- Negative troponin
- Tele: Non sustained V-tach
- EF 25%

Syncope Evaluation

TABLE 1

Types of syncope

Neurally mediated (60%–70%)
Vasovagal
Situational
Carotid sinus hypersensitivity
Postexertional

Orthostatic (10%)

Cardiac (10%–20%)
Structural heart disease with cardiac obstruction
Ventricular tachycardia
(structural heart disease or primary electrical disease)
Bradyarrhythmias
(degenerative conduction disease, drug effect, structural heart disease)

Other
Acute illness
Arterial occlusion with neurologic deficit
(carotid, vertebrobasilar, proximal subclavian)
Psychogenic

https://www.ccjm.org/content/ccjom/81/12/755.full.pdf

- Lack of prodrome is worrisome for electrical onset of "bad" rhythm, especially in patient with low EF
- "Pseudoseizure" occurs when brain is not perfused during syncope and patient remains upright, *no post-ictal state*
- Sudden cardiac death presumed due to tachyarrhythmia, indicates ICD for secondary prevention

Question 14. (55)

- A; Exercise echocardiography

Evaluate symptomatic mitral stenosis with exercise echocardiography

Problem List

- 45 yo woman with HTN
- Chronic dyspnea with exertion, interfering with ADLs
- Sustained apical impulse, not displaced. S1 increased, early diastolic sound followed by soft rumble at apex
- Echo: moderate rheumatic mitral stenosis. Minimal MR
- Gradient: 8 mm Hg, Valve area: 1.8 cm2, Moderate pulmonary HTN 45 mm Hg, Pliable mitral valve

MV Stenosis - Quantification

1. Mean diastolic trans-mitral pressure gradient
2. MV area
3. Secondary changes including LA enlargement and right sided increased chamber size and pressure

Severe Mitral Stenosis:
Gradient $\geq$ 10 mm Hg
Valve area $\leq$ 1.5 cm

MV stenosis stress testing (stress echocardiogram)

Discrepancy between the reported symptoms and the severity of MS.

- "Asymptomatic" with severe MS → exercise testing can help confirm if the patient is able to achieve an adequate workload without the development of symptoms.
- Moderate MS and "severe" symptoms → stress testing can unmask hemodynamically significant MS during exercise.
- Typically, in addition to recording symptoms, MV gradients and estimated right-sided pressures should be measured during the stress test and these results included in the decision-making regarding intervention.

Question 15. (57)

- D; Repeat echocardiogram in 6 months

Manage a patient with bicuspid aortic valve and enlarged aortic root with survelliance echocardiography

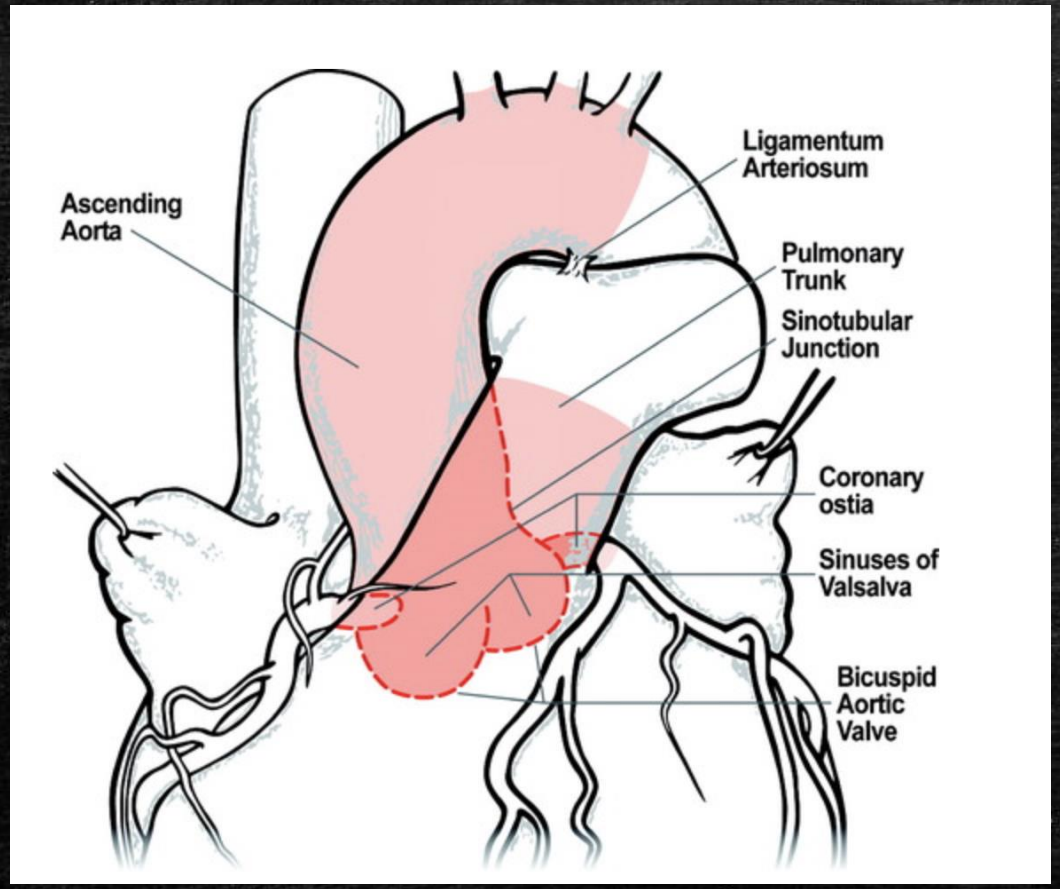
Problem List

- 57 yo man HTN and bicuspid aortic valve with enlarged aortic root 5.1. cm 6 mos ago; asymptomatic, exercises regularly
- Midsystolic click, grade 2/6 crescendo-decrescendo murmur 2nd right intercostal space
- Normal LV EF; gradient 20 mm Hg; valve area 1.6 cm2
- Ascending aorta root 5.1 cm (unchanged)

Bicuspid Aortic Valve

- The most common congenital cardiac abnormality is bicuspid aortic valve affecting 1-2% of the U.S. population.
- Over time, one-third to one-half of such valves become stenotic, with significant narrowing of the aortic orifice typically developing in the 5th and 6th decades of life.
- Sometimes with associated aortopathy.

Ascending Aortic Dilatation associated with a Bicuspid Aortic Valve



https://www.ahajournals.org/doi/full/10.1161/circulationaha.108.795401

- Most common congenital cardiac condition (0.46-1.37%)
- Autosomal dominant with variable penetrance
- Annual Surveillance when > 4 cm with echo, CT or MRI
- Q 6 months surveillance > 4.5 cm or increase by 0.5 cm in one year
- Elective Repair Recommended:
  - Asymptomatic ≥ 5.5 cm
  - Asymptomatic ≥ 5.0 cm with additional risk factor

https://www.acc.org/latest-in-cardiology/ten-points-to-remember/2015/12/03/16/20/surgery-for-aortic-dilatation-in-patients-with-bicuspid-aortic-valves

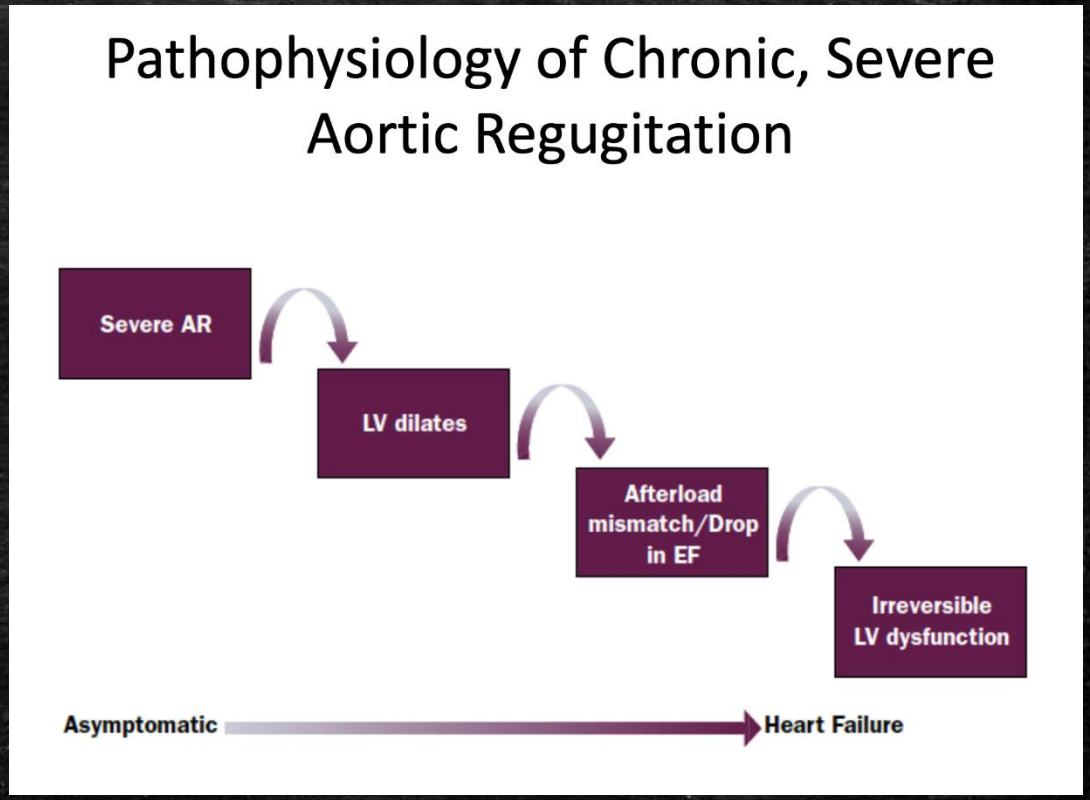
Question 16. (63)

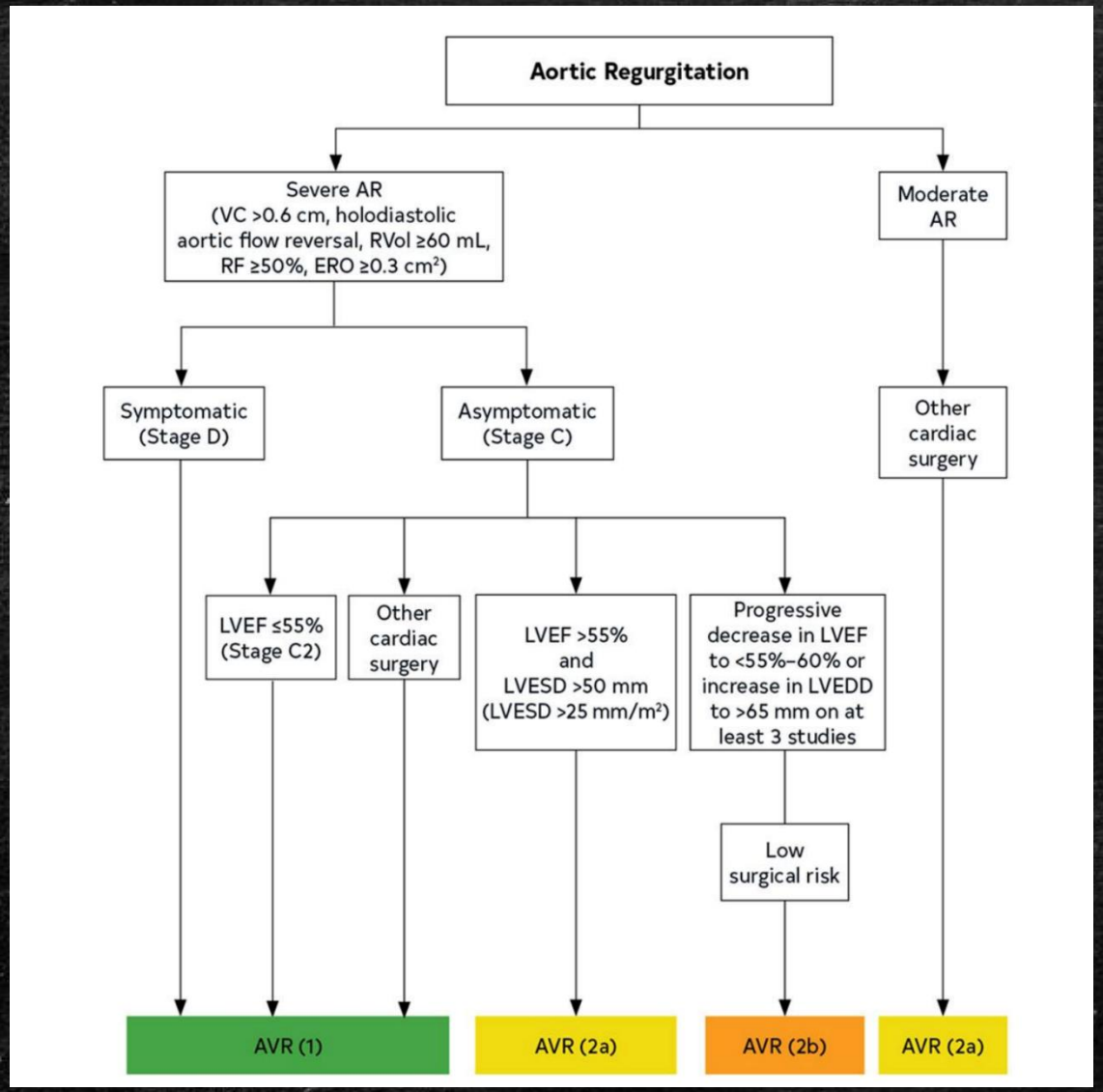
- D; Clinical and echocardiographic follow up in 6 to 12 months

Manage aortic regurgitation that does not meet criteria for surgical valve replacement

Problem List

- 73 yo man, active, runner and asymptomatic
- Grade 3/6 diastolic decrescendo murmur at LLSB
- Aortic regurgitation, EF 65%, end-systolic dimension of 40 mm





Surgery for Chronic Severe AR

Symptoms (any)

LV dysfunction (EF < 55%)

LV enlargement (ESD > 50mm)

In the absence of indications for surgery, clinical evaluation and surveillance echocardiography every 6 to 12 months is recommended.

Question 17. (70)

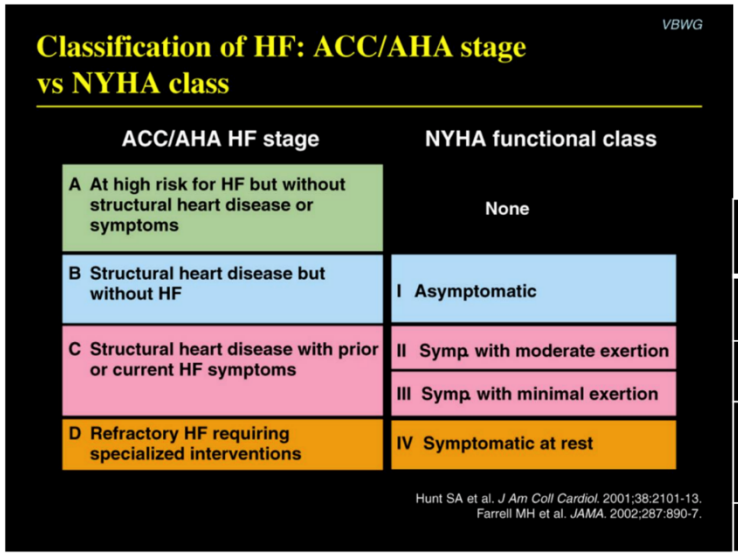
- A; Add bisoprolol

Treat Heart Failure with Reduced EF with B-blocker Therapy

Problem List

- 69 yo man with HTN, HLP, and HFrEF 30% hospitalized with recent exacerbation, now improved
- Enalapril, furosemide, low dose aspirin, and atorvastatin
- Physical exam is normal

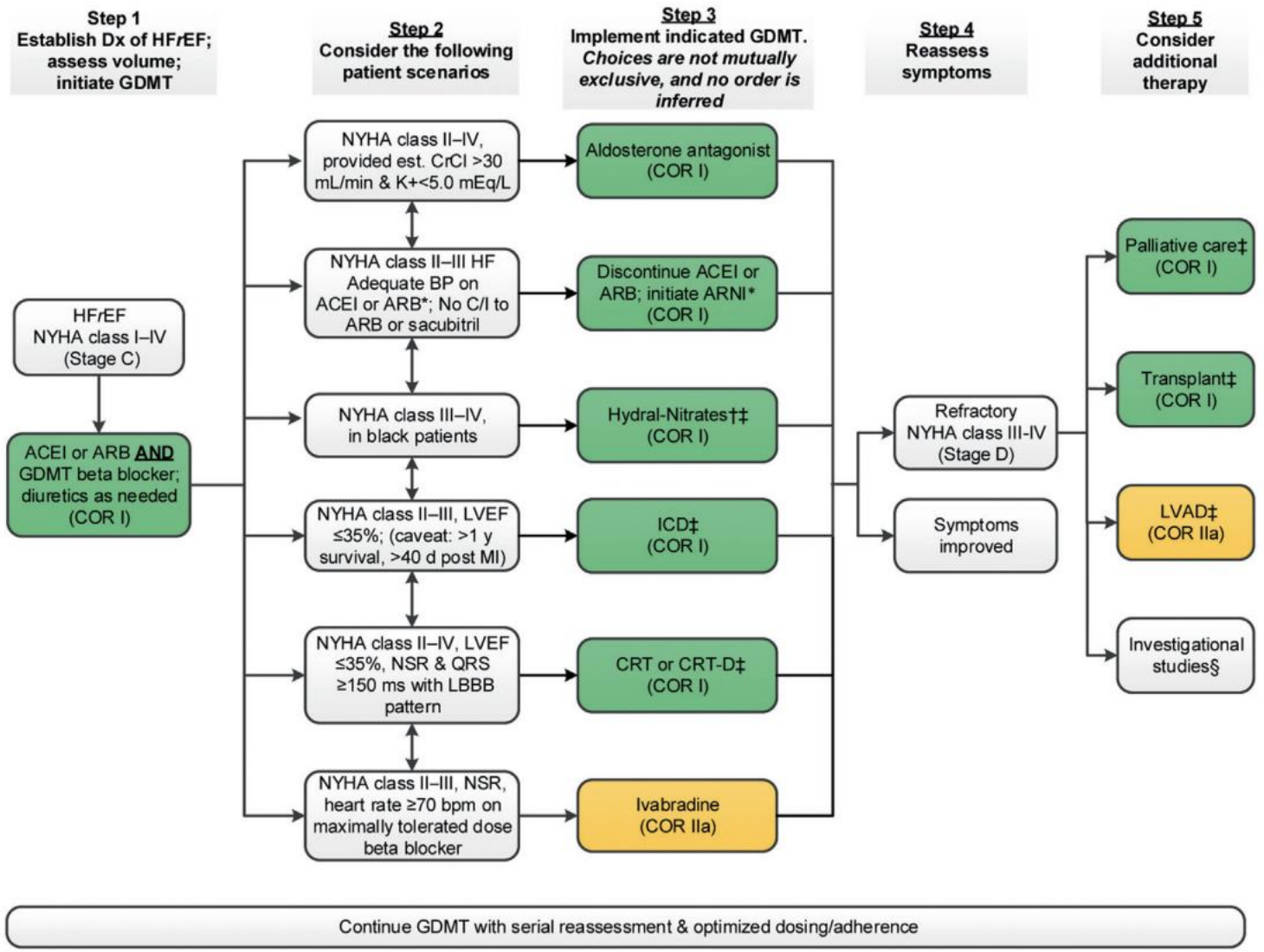
Clinical Class remains the #1 predictor of mortality in Heart failure



Hospital Admission	Annual Mortality
Rare	<10%
≤ 1	10-15%
2 – 4	20%
>4	35-50%

https://www.jacc.org/doi/pdf/10.1016/j.jacc.2017.04.025

FIGURE 2 Treatment of HF*r*EF Stage C and D



https://www.jacc.org/doi/pdf/10.1016/j.jacc.2017.04.025

Demonstrated benefits of guideline-recommended heart failure therapies

Guideline-recommended therapy	Relative risk reductions in pivotal randomized clinical trial(s) (%)	Number needed to treat for mortality benefit (standardized to 12 m)	Relative risk reduction in meta-analysis
Angiotensin converting enzyme inhibitor OR angiotensin II receptor blocker	17	77	20%
Beta-blocker therapy (carvedilol, bisoprolol, extended release metoprolol succinate)	34	28	31%
Mineralocorticoid receptor antagonist	30	18	25%
Hydralazine plus nitrate	43	21	Not available
Cardiac resynchronization therapy	36	24	29/22%
Implantable cardioverter-defibrillator	23	70	26%

Original figure modified for this publication. Fonarow GC, Yancy CW, Hernandez AF, et al. Potential impact of optimal implementation of evidence-based heart failure therapies on mortality. Am Heart J 2011; 161:1024. Table used with the permission of Elsevier Inc. All rights reserved.

First-line drugs:

- ACEI/ARB/ARNI (Hydralazine+nitrate if contraindicated)
- B-blocker
- Diuretic

Second-line drugs:

- MRA
- Ivabradine
- Dapagliflozin
- Hydralazine + Nitrate
- Digoxin

Question 18. (77)

- C; Repeat aortic ultrasonography in 24 to 36 months

Manage an Abdominal Aortic Aneurysm with Surveillance

Problem List

- 68 yo man with HTN, HLP, total lifetime smoking 50 pk/yr, quit 23 years ago
- Low dose aspirin, atorvastatin, amlodipine
- AAA 3.5 cm

Recommendation Summary

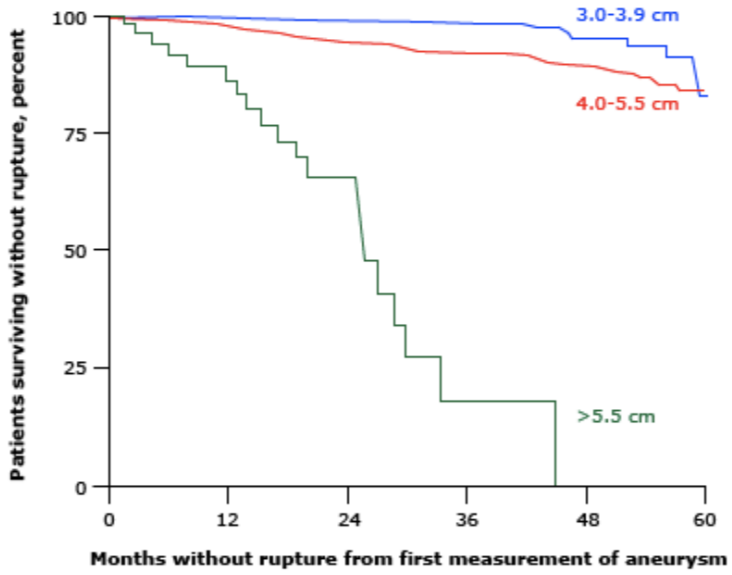
Population	Recommendation	Grade
Men aged 65 to 75 years who have ever smoked	The USPSTF recommends 1-time screening for abdominal aortic aneurysm (AAA) with ultrasonography in men aged 65 to 75 years who have ever smoked.	B
Men aged 65 to 75 years who have never smoked	The USPSTF recommends that clinicians selectively offer screening for AAA with ultrasonography in men aged 65 to 75 years who have never smoked rather than routinely screening all men in this group. Evidence indicates that the net benefit of screening all men in this group is small. In determining whether this service is appropriate in individual cases, patients and clinicians should consider the balance of benefits and harms on the basis of evidence relevant to the patient's medical history, family history, other risk factors, and personal values.	C
Women who have never smoked	The USPSTF recommends against routine screening for AAA with ultrasonography in women who have never smoked and have no family history of AAA.	D
Women aged 65 to 75 years who have ever smoked	The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening for AAA with ultrasonography in women aged 65 to 75 years who have ever smoked or have a family history of AAA.	I

https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/abdominal-aortic-aneurysm-screening

Manage an Abdominal Aortic Aneurysm with Surveillance

- The optimal surveillance schedule for patients who are not undergoing AAA repair has not been clearly defined.
- The Society for Vascular Surgery (SVS) guidelines recommend surveillance every 6 to 12 months using ultrasound or computed tomography (CT) for medium-sized aneurysms (4.0 to 5.4 cm in diameter) but less frequent intervals for smaller aneurysms
- Surveillance for smaller aneurysms may be 24-36 months

AAA rupture primarily occurs in larger aneurysms



Risk of rupture of an abdominal aortic aneurysm (AAA) over time according to the first measurement of aneurysm diameter in 1792 men and 465 women. The risk of rupture increased markedly in aneurysms larger than 5.5 cm in diameter.

Data from: Powell, JT, Greenhalgh, RM, N Engl J Med 2003; 348:1895.

https://www.uptodate.com/contents/management-of-asymptomatic-abdominal-aortic-aneurysm?topicRef=7569&source=related_link#H909597049

Question 19. (81)

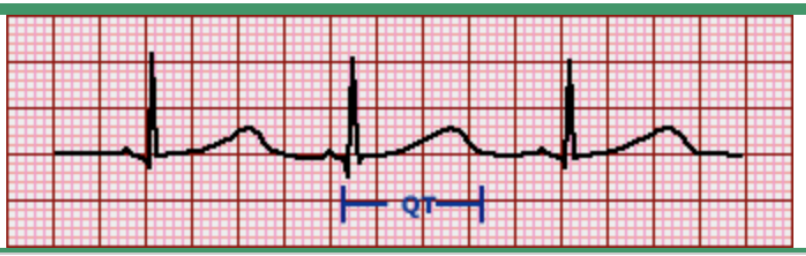
- B; Moxifloxacin

Manage Acquired QTc-interval prolongation

Problem List

- 51 yo woman with HTN, HLP, and depression with CAP admitted to ICU, started on moxifloxacin after normal ECG obtained
- Venlafaxine, carvedilol, simvastatin
- 20 second spontaneously terminating torsades de pointe
- New ECG QTc is 550 ms

Single-lead electrocardiogram showing a prolonged QT interval



The corrected QT interval (QTc) is calculated by dividing the QT interval (0.60 seconds) by the square root of the preceding RR interval (0.92 seconds). In this case, the QTc is 0.625 seconds (625 milliseconds).

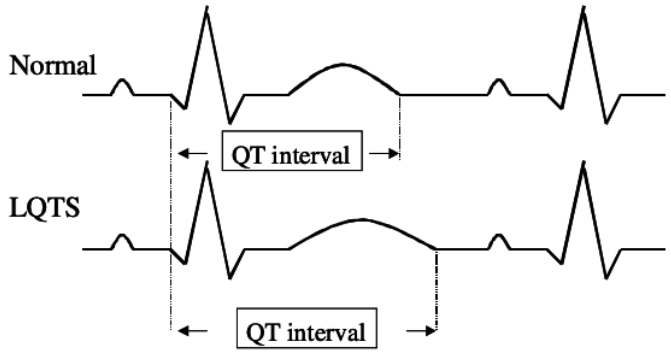
https://jamanetwork.com/journals/jama/fullarticle/1357296

Manage Acquired QTc-interval prolongation

www.sads.org or www.torsade.org.

As of July 31st, there were nine fluoroquinolone antibiotics on the QTdrugs lists maintained by CredibleMeds. Moxifloxacin is on the list with “Known Risk of TdP” and ciprofloxcin is on the “Conditional Risk” list. Norfloxacin, gemifloxacin, ofloxacin, and levofloxacin were on the Possible Risk” list. Three of the nine drugs listed (sparfloxacin, grepafloxacin, and gatifloxacin) include designation that they have been removed from the US and/or worldwide markets.

Hypokalemia
Hypomagnesemia
Hypocalcemia



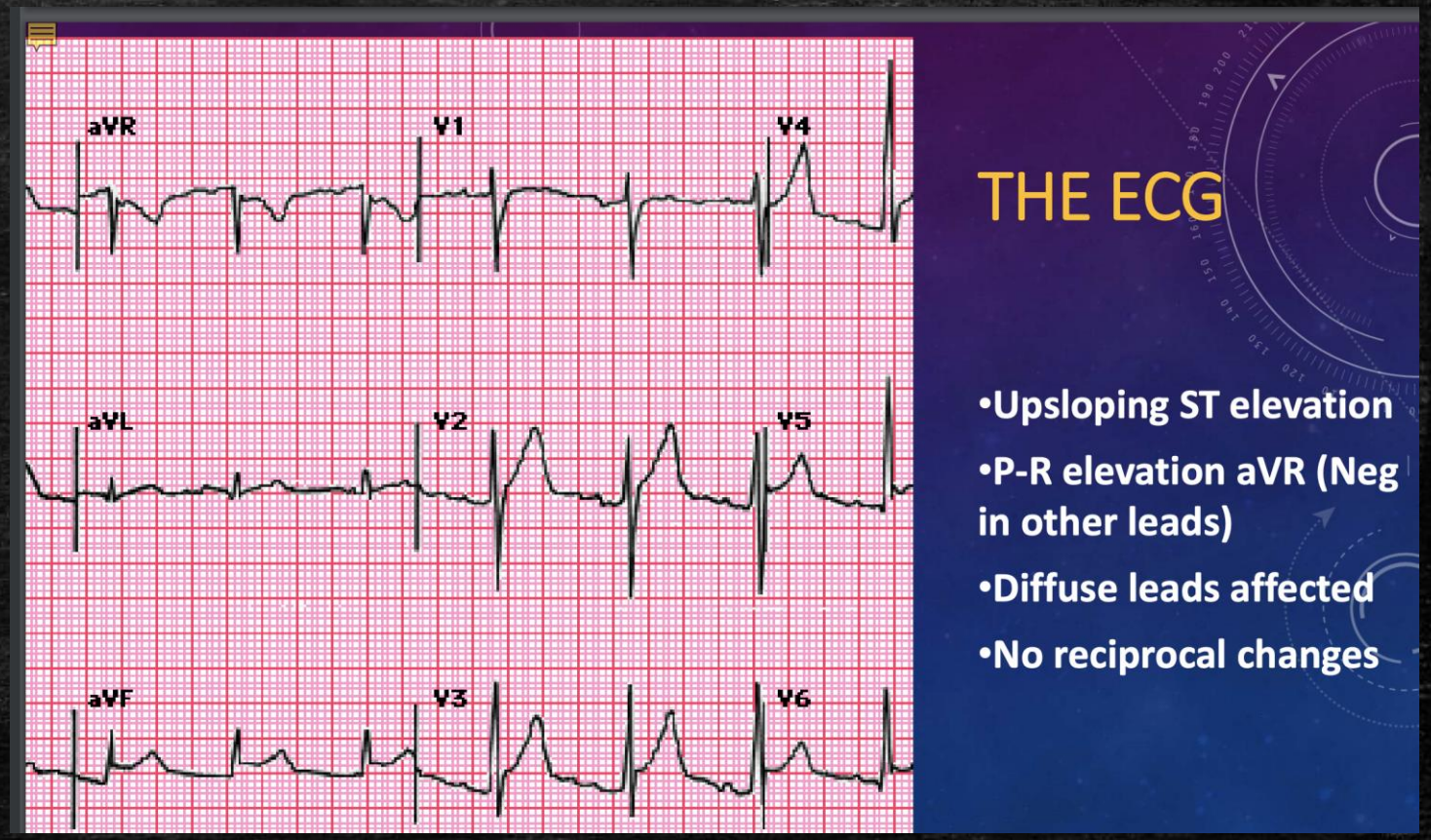
Question 20. (120)

- D; High dose aspirin and colchicine

Treat Acute Pericarditis

Problem List

- 42 yo man with HTN, HLP, presents with acute, sharp persistent chest pain
- Exam is normal
- Elevated CRP, serial troponins normal
- ECG elevated ST segments diffusely, PR depression



TREATMENT OF ACUTE PERICARDITIS IN ADULTS

- **NSAID**
- **Colchicine**
- **Rx Underlying Condition**

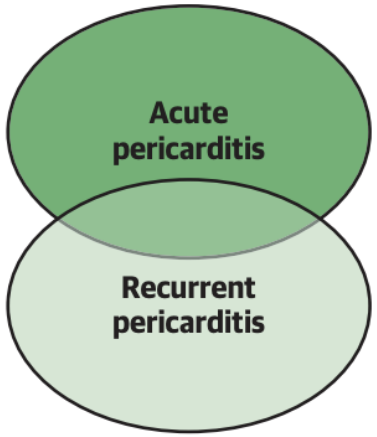
Are any of the following high-risk markers present?

- Fever >38°C (100.4°F)
- Subacute course (without acute onset of chest pain)
- Hemodynamic compromise suggesting cardiac tamponade
- Large pericardial effusion seen by echocardiography
- Immunosuppression or immunodepressed patient
- Treatment with vitamin K antagonist or novel oral anticoagulant
- Acute trauma
- Elevated troponin suggesting myopericarditis

https://www.jacc.org/doi/pdf/10.1016/j.jacc.2019.11.021

If Present Admit to Hospital

FIGURE 3 Treatment for Acute and Recurrent Pericarditis and Their Complications



DRUG	DOSE	DURATION
Aspirin	750-1,000 mg every 8 h	1-2 weeks
Ibuprofen	600-800 mg every 8 h	1-2 weeks
Colchicine	0.5-1.2 mg in one or divided doses	3 months
Aspirin	750-1,000 mg every 8 h	Weeks-months
Ibuprofen	600-800 mg every 8 h	Weeks-months
Indomethacin	25-50 mg every 8 h	Weeks-months
Colchicine	0.5-1.2 mg in one or divided doses	At least 6 months
Prednisone	0.2-0.5 mg/kg/daily	Months
Anakinra	1-2 mg/kg/daily up to 100 mg/daily	Months
Rilonacept	320 mg once, then 160 mg weekly	Months
Azathioprine	1 mg/kg/daily up to 2-3 mg/kg/daily	Months
Methotrexate	10-15 mg weekly	Months
MMF	2,000 mg daily	Months
IVIGs	400-500 mg/kg/day	5 days

Tamponade

Pericardiocentesis

Pericardial window

Constrictive pericarditis

Active inflammation
- Yes → Anti-inflammatory therapy as first line, pericardiectomy for refractory cases
- No → Pericardiectomy

Different treatments, their dosing, and duration according to clinical presentation are summarized. IVIGs = intravenous immunoglobulins; MMF = mycophenolate mofetil.

Check for drug-drug interactions with colchicine!