Rules for the Next 60 Minutes are Simple

- All cases are real.
- Nothing unusual.
- Can be figured out with a history, good cardiac examination, and an EKG.
- Think about epidemiology and physiology.
- Coronary, valvular, myocardial, pericardial, and vascular conditions.

Rxxx59744

60 year old woman with 2 weeks of upper neck and shoulder discomfort. Usually occurs just as she lies down in bed each night, though she had one episode as she was climbing stairs while carrying her briefcase. No shortness of breath or diaphoresis.

- Osteoarthritis, S/P knee replacement 2 years previously.
- Chronic left rotator cuff difficulties.
- Strong family history of premature CAD.
- BMI 32
- Hypertension, vigorously treated, and controlled.
- Type 2 Diabetes with A1c 7.2%.
- Dyslipidemia treated with statin, with TC185 HDL50 LDL98 TG 211.

Medications: asa, atenolol, lisinopril, furosemide, basal insulin, metformin, pravastatin

Exam:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>JVP</td>
<td>not elevated</td>
</tr>
<tr>
<td>Carotid upstrokes and volumes</td>
<td>normal</td>
</tr>
<tr>
<td>Clear lungs</td>
<td></td>
</tr>
<tr>
<td>PMI</td>
<td>non-disp.</td>
</tr>
<tr>
<td>S1</td>
<td>normal</td>
</tr>
<tr>
<td>S2</td>
<td>Ø</td>
</tr>
<tr>
<td>2/6 systolic murmur</td>
<td>LSB, early peaking, decreases with valsalva.</td>
</tr>
<tr>
<td>Left arm hurts with rotation. Has neck sensation during exam.</td>
<td></td>
</tr>
</tbody>
</table>

Appropriate Next Steps Include:

- Questions about jaw claudication, ocular symptoms, and palpation of temporal arteries.
- Ordering 24 hour continuous monitor or 30 day looping monitor, looking for supraventricular arrhythmia (AVNRT), that is known for “frog sign,” that may account for neck discomfort.
- Questions about sour taste, spicy food exacerbation, and if suggestive of reflux symptoms, initiating a PPI.
- Performing an immediate EKG.
- Sending patient for full laboratory studies, including CBC, ESR, CRP, BMP, Cardiac markers, and EKG.
- a, c, e.
- a, and if unrevealing, b.
What are A1c, BP, and lipid targets?

- A. A1c<7.0%, BP<120, TG<150 mg/dl.
- B. A1c<7.0% if not hard to achieve, BP<140, LDL<100, TG not tackled independently.
- C. None of the above.

Case Study

• 51 year old man with 4 months of exertional dyspnea
  – Treated dyslipidemia and hypertension
  – Brother had myocardial infarction at 52
  – Medications: atorvastatin and lisinopril
  – Resting Echo: normal EF 55%
    • 6 minutes 57 seconds STD Bruce protocol
    • HR 173 BP 190/80
    • At HR 130, 1.0 mm inferolateral ST segment depression that resolved after 10 minutes of recovery
  – Stress Echo: Akinetic mid anterior, apical inferoapical segment with EF 55%

Next Steps

A. Initiate medical therapy and suggest cath. Revascularization will depend on anatomy.
B. Initiate medical therapy and suggest cath. No matter how complex the anatomy, SYNTAX suggests that drug eluting stents and cardiac surgery confer same benefit in terms of death, MI, and need for repeat revascularization.
C. Initiate medical therapy. No reason to cath based on COURAGE Trial. Cath if symptoms worsen or stress test does not improve, based on COURAGE sub study.

Clinical Outcomes Utilization
Revascularization and Aggressive Drug Evaluation (COURAGE)

• Medical or PCI & Medical Rx for stable angina
  – At least 70% stenosis with objective evidence for ischemia
  – 80% stenosis with angina
  – Exclude: EF <30%
  – Revascularization within 6 months
  – ETT strongly positive in Stage I
  – Anatomy not suitable for PCI
  – Primary endpoint: Death or MI
  – Enrolled 1999-2004 (few DES)
  – Average follow-up 4.6 years

COURAGE
Baseline Clinical, Exercise, and Angiogram Characteristics

- Age 61
- Male 85%
- Angina Class
  - II →12%
  - III →30%
  - III →36%
  - III →23%
- DM 35%
- CHF 4%
- Treadmill duration 7 minutes
- Nuclear Imaging
  - 1 reversible defect → 22%
  - >1 → 65%
- EF 60%
- Number of Vessels
  - 1 → 31%
  - 2 → 39%
  - 3 → 30%
  - Proximal LAD → 31%
- Proximal LAD → 31%

COURAGE Results
4.6 Years

<table>
<thead>
<tr>
<th></th>
<th>PCI</th>
<th>MED</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death and non-fatal MI</td>
<td>19</td>
<td>18.5</td>
<td>0.62</td>
</tr>
<tr>
<td>Death</td>
<td>7.6</td>
<td>8.3</td>
<td>0.87</td>
</tr>
<tr>
<td>Revasc-PCI or CABG</td>
<td>21.1</td>
<td>32.6</td>
<td>0.001</td>
</tr>
</tbody>
</table>
61 y.o. man with sudden onset shortness of breath 3 days post left total knee replacement.
HT, dyslipidemia, previous radical prostatectomy, traumatic splenectomy.

Exam: Anxious and diaphoretic 98° 108/60 20 RA pulse ox 79%
JVP not elevated Carotid upstrokes and volumes normal.
Crackles left lung base.
PMI not displaced. No sternal lift.
N1 S1, S2 physiologically split. P2 not increased.
Left leg swollen, above and below knee.
Tr I 0.75 Ck 105 MB 3.7.

Which of the following statements are true?

a. This man, with multiple CAD risk factors, is most likely having an acute coronary syndrome. He should be heparinized and he should have coronary angiography.

b. This man, s/p orthopedic surgery, is most likely struggling with a pulmonary embolism. He should be heparinized and have an echocardiogram.

c. This man should receive lytic therapy immediately which will be helpful in either circumstance.
What are logical next steps?

a. Lytic agents, given size of PE.
b. IVC Filter and lytic agents.
c. IVC filter and ongoing heparinization.
d. IVC filter and catheter or surgical embolectomy and ongoing heparinization.

47 y.o. man with several weeks of increasing dyspnea

- Age 40, episode of chest pain and shortness of breath. No further treatment.
- Age 43, for progressive shortness of breath, had CT-PE, and told of large clot in lungs. Anticoagulated.
- Reported HT, dyslipidemia, FH of “clots”
- Medications: Diltiazem, furosemide, atorvastatin, and warfarin

Exam

- 120/82 mmHg   HR 72   RR 14  94%- RA
- JVP 8-9 cm, prominent “a” wave
- Clear lungs
- Left parasternal lift. PMI displaced laterally. Normal sounding S1, physiologically split S2, with P2 heard at apex, as well as in pulmonic and left lower sternal border regions.

2/6 harsh systolic murmer at LLSB, increased with insp.

- Labs: Tr-T below assay.
- EKG: 72  0.19/0.08/0.42 100 degree axis right atrial abnormality, right precordial T wave inversions

ED reports: CT-PE shows occlusive right main PA thrombus and left lower lobe segmental thrombus. RV dilated.
Next steps

A. Lytic agents for acute large PE, with EKG, RV changes and risk of early decompensation.
B. Heparinization and change to LMWH for small PE atop chronic thromboembolic pulmonary HT.
C. Echocardiogram, and if significant pulmonary HT, TR confirmed, elective surgical RX for CTEPH.

58 y.o. woman transported from dialysis center with left arm and chest discomfort and sense of “not feeling well.”
Bipolar disorder and in problematic marriage with alcohol dependent husband.
ESRD secondary to prior lithium toxicity. Impaired glucose tolerance. Dyslipidemia.
Catheterization 15 months prior for chest pain and reported NSTEMI: PA 45/10 mmHg, No gradient across outflow tract or aorta. EF 65%. 30% LAD and LCx stenoses.

Exam: Feeling better
126/80 92 14 pulse ox 97% on 2L.
JVP not elevated. Carotid upstrokes brisk, volumes normal.
Right base crackles. Non-displaced PMI. Normal, non-muffled S1, S2
Tr I 0.29.  HCT 30.

Echo Tech is on way.
Which of following statements are true:
a. Presentation is consistent with coronary spasm, stress induced cardiomyopathy, or plaque rupture. Echo will distinguish between these entities.
b. No matter what echo shows, she should undergo angiography.
c. No matter what echo shows, there is no need for angiography.
d. She may have had stress induced cardiomyopathy last time she had catheterization, and likelihood of a recurrence is very, very low.
e. a and d.

82 year old man with 2 years of slowly progressive exertional dyspnea and fatigue.
• Seasonal allergies and asthma.
• Hypertension.
• PAD. 7 years previously, Aortobifemoral graft with extension into the left common iliac and right internal iliac, for incidentally noted 5.2 cm iliac aneurysm and ectatic infrarenal aorta.
• Dyslipidemia.
• Impaired glucose tolerance.

Medications: lisinopril, terazosin, simvastatin, fluticasone
Exam: 191 lbs 71” 142/68 80 12

Carotid upstrokes normal.
Carotid volumes low normal.
PMI not displaced.
Nil S1, soft single S2, heard only over left upper sternal border.
High pitched, late peaking systolic murmur that is heard from apex to neck and that decreases with valsala.
Normal distal pulses.

80 year old man with easily precipitated external angina (after a meal, has angina if he walks across a street). Duration 1yr.
Hypertension and CKD. Cr 1.7 mg/dl. Treated with Lisinopril and Metoprolol.
Dyslipidemia, with remote TC 340 mg/dl. Presently, TC 174, HDL 81, LDL 71 TG 71. Treated with Simvastatin and Niacin.
Type 2 Diabetes. A1c 7.4%. Treated with Glipizide.

Initial investigations for cause of patient’s symptoms should focus on:

- a. Hypertensive heart disease, with decreased diastolic compliance.
- b. Progressive airways impairment.
- c. Epicardial coronary artery disease, with important stenoses.
- d. Coronary ectasia.
- e. Aortic stenosis.
- f. All except e.

1988 Evolving anterior MI, received TPA, then under went LIMA-OMB, SVG-AM, sequential SVG-D1-LAD.

Received SVG-A.M, SVG-LAD

Early myelodysplastic syndrome, Plts 80 K/uL range. Quit smoking in 3rd decade. Works everyday as hands on manager in a distribution company.

Exam:

184 lbs, extra 15 lbs. in abdomen.
149/64 in both arms. 60 regular. 12. Terrific memory.
JVP< 8 cm. Carotid upstrokes with slight delay. Volumes Good. Transmitted murmur.
Clear lungs.
Normal S1. Single S2, heard only over pulmonic region. 3/6 late peaking, nearly honking systolic murmur heard from apex to base to neck and in back.
Softens with valsala.
Normal distal pulses.
Most likely reason(s) for this patient’s easily precipitated angina (worse post prandial)

A. Hiatal hernia + Para esophageal hernia without erosive esophagitis.
B. Aortic stenosis combined with or without native or graft coronary disease.
C. Mitral regurgitation and hypertensive/diabetic microvascular impairment.
D. Worsening anemia and outflow tract obstruction.
E. Left subclavian stenosis jeopardizing flow to LIMA.

ECHO:

EDD 5.6  ESD 4.1 wall thickness 1.4cm
EF 50% no wall motion abnormalities.

Heavily calcified aortic valve.
Mean gradient 44
VMAX 4.4 m/sec  TVI below 23, above 119
AVA 0.7cm².

Next best steps.

A. CATH with assessment of iliofemoral system, then discussion with surgeons and interventionalists.
B. Increase beta blocker for stable angina.
C. Further observation until develops symptoms related to critical aortic stenosis, SOB or light headedness.
D. Radial cath, to minimize risk of perturbation, with plans for SAVR +/- CABG.

CATH:

• Patient grafts.
• RCA occluded after acute marginal.
  Good L→R collaterals. Acute marginal mid 95% stenosis.
• Occluded left main.
• Far distal LAD 80% stenosis.
• Fully patient, large iliofemoral systems.

Patient states he is willing to abide by recommendation, convene surgeons and interventionalists.

A. CABG and SAVR
B. PCI and TAVR
C. PCI and SAVR
D. TAVR alone
E. Medical management
F. All of the above
G. All except E.

Following patients with Aortic Stenosis

89 pts sent to Echo Lab with at least moderate aortic stenosis, V max 3-4 msec.
<57 had as suspected when sent for echo.
39 year old woman who feels well. Occasional orthostatic lightheadedness.
- Maternal Grandfather died at age 55.
- No history of heart murmur.

Medications: estrogen/progesterone, zolpidem.

Exam:
- 68" 120 lbs 100/70 62 90/60 70
- Neck veins: not elevated.
- Carotids: Upstrokes brisk. Volumes normal, not increased.
- Clear lungs.
- Minimal pectus excavatum.
- PMI: 5th intercostal space. Mid clavicular line. No thrill.
- Loud S₁ and physiologically split S₂.
- 3/6 systolic murmur loudest just left of lower left sternal boarder.
- With valsalva, murmur becomes minimally louder.
- With handgrip, extra sound heard after S₁, murmur moves later.

Diagnosis:
- Autonomic insufficiency, unclear etiology.
- Mitral stenosis.
- Obstructive hypertrophic cardiomyopathy.
- Mitral valve prolapse and mild mitral regurgitation. Can follow with yearly exams.
- Posterior mitral valve prolapse and significant mitral regurgitation.
- a and d.

51 year old woman with abrupt onset pleuritic chest discomfort, worse supine.
- Hodgkins disease stage II A, 22 years previously, treated with mantle RT and MOPP following splenectomy.
- Treated hypothyroidism.
- Soley DVT 3 years previously.
- Contrast allergy.

Medications: None.

Exam:
- Uncomfortable, 110/80 110 20
- Neck veins: Mid neck level, seated upright, collapse with inspiration.
- Carotid upstrokes brisk, volume diminished.
- Clear lungs. No palpable PMI.
- S₁ normal, S₂ single.
- 2/6 Early peaking systolic murmur along LSB, radiating to neck. Decreases with valsalva.
- No peripheral edema.
Which of the following four statements are true:

a. Pleuritic discomfort against her background of DVT suggests pulmonary embolism as possible diagnosis.
b. Radiation and symptoms suggest pericardial processes that could include effusive disease or effusive constrictive disease.
c. Prior radiation and symptoms suggest chronic constrictive pericarditis.
d. Appropriate testing would include ventilation perfusion study and surface echo-doppler.
e. All except c.
f. All except b.

Echo:
Large circumferential pericardial effusion.
No diastolic collapse of RV or RA.
Transmitral early filling falls 35% with inspiration.
Transtricuspid early filling increases 75% with inspiration.

Hemodynamics:
All diastolic pressures between 18-20 mmHg.
Blunted “Y” descent in RA.
Blunted early filling in RV.
Pericardial pressure =
a. 18-20
b. Zero
c. 5-10 mmHg.

88 year old woman with 6 months of exertional and cold induced throat discomfort, culminating in severe dyspnea and orthopnea.
• Daughter, in 6th decade, underwent coronary artery surgery.
• Mild dyslipidemia.
Medications: None

Exam: 110/80 90 20
Neck veins: Mid neck level. Prominent pulsations.
Carotids: Low volume and delayed upstroke.
Dull lung bases.
Sternal lift. PMI in 6th intercostal space, mid axillary line.
Normal sounding S1.
Single S2, heard only at left upper sternal boarder.
Soft, long lasting systolic murmur from apex to neck; decreases with valsalva.
Apical systolic murmur that does not change with valsalva.
Becomes louder with handgrips.
Left lower sternal boarder systolic murmur that becomes honking with inspiration.
2+ bilateral lower extremity swelling.
Most likely cause for patients symptoms:

- Critical aortic stenosis.
- Mitral regurgitation.
- Tricuspid regurgitation.
- Secondary pulmonary hypertension.
- Advanced epicardial CAD.
- a and e.
- a through e.

60 year old man with abrupt onset of lightheadedness and shortness of breath.

- Mother, with hypertrophic cardiomyopathy, resuscitated from 2 arrests in 8th decade and ultimately died with cerebral embolic event and atrial fibrillation.
- Hypertrophic cardiomyopathy, found by screening. Septum 2.1cm. Outflow tract gradient at rest <20mmHg.
- Received dual chamber ICD.
- Usually A-paced, with first degree A-V block.
- Dyslipidemia.
- Underwent LAD angioplasty 18 years previously.

Medications: betaxolol, rosuvastatin, asa.

Exam: 193 lbs 68” 100/70 70 18
- Intermittent bounding neck veins.
- Variable S₁. Paradoxically split S₂.
- Intermittent systolic murmur along left sternal border. Decreases with valsalva.
Patients symptoms are most likely related to:

a. Obstructive hypertrophic cardiomyopathy with intermittent obstruction.
b. Pacemaker syndrome from poor pacer programming.
c. CAD
d. “End of Life” pacing.
e. All except b.

60 year old man with 2 days of resting shortness of breath and chest heaviness.
- Discontinued significant alcohol use 2 years previously.
- Smoker.
- Type 2 diabetes A1c 6.7%.
- Hypertension.
- 18 years previously for EF 35% and 3+ aortic insufficiency related to a prolapsing right coronary leaflet, underwent aortic valve repair.
  Echo 3 months later “good repair, 2+ AI, dilated aortic root, EF improved.

Medications: atenolol, furosemide, amiodipine, metformin, atorvastatin.

Exam:
- Neck has visible pulses, at jaw angle, that do not compress.
- PMI felt along anterior axillary line.
- Normal sounding S1, single S2. Early peaking LSB systolic murmur that radiates to the neck and does not change with valsalva.
- Diastolic rumble at apex.
- Sitting up, LSB brief diastolic murmur.
- No pedal edema. Strong distal pulses.

Labs: TrI 0.15, 0.12, 0.13, BNP 657

EKG:

This patients symptoms are most likely related to:

a. Acute coronary syndrome.
b. Mitral stenosis.
c. Acute aortic insufficiency.
d. Chronic aortic insufficiency.
e. Decompensated chronic LV failure

57 year old woman with 1 year of intermittent left arm heaviness and right eye difficulties, culminating in an admission for > 24hrs of left arm numbness


Left knee osteoarthritis, treated with COX2 inhibitors. Family history of premature CAD. Hypertension treated with beta blocker and Lisinopril. Dyslipidemia, only able to tolerate low dose of Simvastatin. LDL >150mg/dl.

Age 55 cath for chest squeezing, and stress echo notable for ST segment changes and anteroseptal hypokinesis. EF 60%, 50% ostial D, stenosis. 40% LCX stenosis.
Exam:
164 lbs. (excess 25 lbs in abdomen)
160/80-112/70 70 12
JVP < 8 cm. Normal carotid upstrokes and volumes.
Soft right carotid bruit.
Normal S1, S2 Ø split.
LLSB systolic murmur. Early peaking, decreased with Valsalva. No neurologic deficits.
Medications: ASA, Beta blocker, Lisinopril, Simvastatin

MRI/A:
Right front parietal multiple small strokes, including some acute. Moderate (60%) right internal carotid stenosis and additional, more distal, diffuse narrowing.

TEE:
Atrial septal aneurysm and PFO, with clear cut appearance of agitated saline bubbles in left atrium within first beat.
Hypercoaguable studies (-)
24 hour holter (-)

Which of the following statements are true?
A. This patient, below the age of 60, but with hypertension and a stroke, has symptomatic, carotid artery disease and is a reasonable candidate for either carotid stenting or endarterectomy.
B. This patient has had a cryptogenic stroke.
C. This patient should undergo PFO closure.
D. 24hr holter virtually excludes atrial fibrillation as possible cause of her neurologic events.
E. All of the above.
F. None of the above.

75 year old woman with easily precipitated exertional angina for more than 1 year.
-Quit smoking in 5th decade.
-Father and paternal grandfather had myocardial infarctions in 6th decade.
-TC 180, HDL 70, LDL 92, TG 91 on Atorva 40mg
-Impaired glucose tolerance, with A1c 6.3%, treated with Metformin.
-Hypertension treated with B-blocker and ACE I.
Crohns disease- stable

Exam:
127 lbs. (trim) 140/70 both arms. 58. 12.
JVP not elevated (<8)
Carotid upstrokes and volumes normal. Clear lungs. PMI not displaced. S1, S2 Ø with mid systolic click at apex that moves earlier in cardiac cycle with Valsalva.

1. Exercises (outside)
   7 minutes 30 seconds STD Bruce. Stops 2° chest pain and SOB. HR 118 BP 164/70
   1.5mm horizontal ST segment depression that resolves after 3 minutes of recovery. Perfusion images normal. EF 77%.
2. CTA (outside)
   40-50% proximal LAD and LCx stenoses.
   30% mid RCA stenosis
Which of the following statements are true?

A. The story and studies are consistent with important epicardial coronary disease, and if symptoms cannot be managed, coronary angiography is indicated.

B. The story and studies are consistent with microvascular angina with an outstanding prognosis and her medical regimen can be reduced.

C. The story is consistent with mitral valve prolapse.

D. The story is consistent with the non-GI effects of Crohn's disease.