

WHO?

- ASYMPTOMATIC:
 - ROUTINE H&P, INS EXAMS, PRE-OP
- SYMPTOMATIC:
 - ATYPICAL CHEST PAIN
 - DOE/SOB/COUGH SYNDROMES
 - PRE-OP
 - KNOWN CAD PATIENT/ASCVD
 - NEW HEART MU
 - CHF
 - SYNCOPE/LH/DIZ SYNDROMES
 - PALPITATIONS/ARRHYTHMIAS/MVP
 - NEW HEART MURMURS

BASIC QUESTIONS

- CAN I MAKE THIS PATIENT BETTER ?
 - YES (TM + NUCLEAR) NO (TM ALONE) OR (TM + ECHO)
 - EX: ROUTINE, INS EXAM, ACP + AGE<40, SYMP VS ASYMP
- HOW MUCH QUALITY OF LIFE COULD BE LOST IF ?
 - RISK AND HEMODYNAMIC CHALLENGE OF THE SURGERY
- IS THIS PATIENT FRAGILE, FRAIL, DEBILITATED, UNABLE TO DO EXERCISE OR DOES A TERMINAL ILLNESS EXIST ?
 - DESIRABILITY OF MEDICAL VS INTERVENTIONAL THERAPY
 - IF YES DICTATES PHARMACOLOGIC TEST
 - EX: AS, COPD/e/bs, ARTHRITIS syndromes, PVODZ, CVA, EYE, DIZZINESS OR GAIT DISORDER, POSTURAL HYPOTENSION, DM/EOD, SURGERY
- DO I NEED SPECIFICITY, OR DO I NEED SENSITIVITY ?
 - TREADMILL MODE ALWAYS PREFERRED (INC BOTH)
 - ECHO SCANS (SPECIFIC) VS NUCLEAR SCANS (SENSITIVE)

BASIC QUESTIONS

- IS THIS A QUESTION OF FUNCTIONAL CAPACITY ?
ARRHYTHMIA?
 - TREADMILL SUFFICIENT... UNLESS LVEDP, ISCHEMIA (coronary/non-coronary), ISCHEMIC MR- ARE KEY ISSUES
- IS THIS A QUESTION OF EFFICACY OF THERAPY FOR CAD ?
 - NUCLEAR SCANS PREFERRED
- WILL I BELIEVE THE TEST RESULT ?
 - CONSIDER PRETEST LIKELIHOOD OF A POSITIVE RESULT
 - EX: SM30/60/90/120, DM10/20/EOD, FMHX<45<35, VASC BIOLOGY
- ARE CONFOUNDING ISSUES PRESENT ?
 - DIGOXIN, LVH CHIEF ISSUES
 - ALSO HYPERTENSIVE RESPONSE TO EXERCISE (FUNCTIONAL LVH)
 - ALSO AORTIC STENOSIS, ANTI-ARRHYTHMIC AGENTS, CDMP, SIG DM
 - INVALIDATES ECG, and DICTATES ECHO OR NUCLEAR SCAN

BASIC ALGORITHM

- TREADMILL STRESS TEST
 - TREADMILL “YARDSTICK” PREFERRED
 - BEST IN PATIENTS WITH: NORMAL ECG
 - NO CONFOUNDING ISSUES
- STRESS ECHO
 - TREADMILL “YARDSTICK” PREFERRED
 - AGES 30-50
 - EXCELLENT EXERCISE TOLERANCE
 - ASYMPTOMATIC PATIENTS WITH ABOVE
 - ROUTINE H&P, INS, ASXIC PREOP
 - LVH/DIGOXIN/ANTI ARRHYTHMICS OK
 - YOU WISH TO REMOVE DRUG EFFECT, LVH EFFECT, ARTIFACT EFFECT OF PRIOR NUCLEAR SCAN (INCREASE SPECIFICITY)
 - YOU WISH TO EMPHASIZE NORMALITY, AVOID A FALSE POSITIVE RESULT, AND DECREASE UNNECESSARY CATHS/PROCEDURES

BASIC ALGORITHM

- NUCLEAR STRESS TEST
 - TREADMILL “YARDSTICK” PREFERRED, AGE>45 OR INC RISK
 - YOU WISH TO EMPHASIZE SENSITIVITY, CAN’T RISK A FALSE NEGATIVE RESULT, AND ARE COMFORTABLE WITH PROCEEDING TO A CATHETERIZATION/PROCEDURE IF ABNORMAL RESULT

- PHARMACOLOGIC STRESS TEST
 - ADENOSINE and PERSANTINE SCANS VS DOBUTAMINE ECHO
 - SENSITIVITY VS SPECIFICITY
 - IF COPD/emphysema/bronchospasm: DOBUTAMINE ECHO
 - IF QN OF POST ISCHEMIA OR ISCHEMIC MR : DOBUTAMINE ECHO
 - IF AORTIC STENOSIS +/- CAD: ADENOSINE/PERSANTINE
 - IF VENT >> ATRIAL ARRHYTHMIAS: ADENOSINE/PERSANTINE

TEST RESULTS

CLASSIC PATTERNS: THALLIUM

Type	Agent	Red Flag	Sx	Ecg	Lung Uptake	Ef/Wall Motion	Scan Result	Bp ↓
1	Thallium	—	+	+	—	N/A	+	—
2	Thallium	—	+	—	—	N/A	+	—
3	Thallium	—	—	+	—	N/A	+	—
4	Thallium	YES	CDS/DOE	+	+*	N/A	+	—
5	Thallium	YES	CDS/DOE	+	—	N/A	+	+*

Increasing Specificity Of Result By Column (Right To Left) → → →

TEST RESULTS

CLASSIC PATTERNS: NITRILES and ECHO

Type	Agent	Red Flag	Sx	Ecg	Lung Uptake	Ef/Wall Motion	Scan Result	Bp ↓
6	Nitriles and Echo	—	+	+	N/A	Reported	+	—
7	Nitriles and Echo	—	+	—	N/A	Reported	+	—
8	Nitriles and Echo	—	—	+	N/A	Reported	+	—
9	Nitriles and Echo	YES	CDS/DOE	+	N/A	Reported	+	+*

Increasing Specificity Of Result By Column (Right To Left)→→→

INCONGRUENT RESULTS AND INTERPRETATION

- ASYMPTOMATIC PATIENT:
 - BRUCE EX >10MIN, NEG SX, ECG any, POS NUCLEAR SCAN: DO S-ECHO
- SYMPTOMATIC PATIENT (“CDS”):
 - BRUCE EX 6-10 MIN and POS ECG + NEG SCAN: DO S-ECHO

INCONGRUENT RESULTS AND INTERPRETATION

- SYMPTOMATIC PATIENT (“CDS”) Continued:
 - BRUCE EX 6-10 MIN and NEG ECG + NEG SCAN, and clinical concern persists:
 - usually relates to frequency and intensity of symptoms, absence of other acceptable etiologies, increased perceived risk by clinical risk assessment (CRA)
 - **solutions (A):** “definitive” CATH for “repeat offenders” to ER; if not, but a pattern exists with impairment-explore other etiologies:
 - CV: occ due to arrhythmia, or unappreciated postural hypotension syndrome;
 - PULM: subclinical/unappreciated bronchospasm;
 - GI: reflux syndromes vs esophageal spasm;
 - MS: chest wall pain syndromes;
 - CNS: cervical nerve radiculopathies- tend to be active patients);
 - If CRA is increased then consider definitive CATH +/- IVUS, S-ECHO, or use CT calcium score as a “tie-breaker”; also reassess priority of original clinical indication (RAPCI); consider empiric med therapy

INCONGRUENT RESULTS AND INTERPRETATION

- SYMPTOMATIC PATIENT (“CDS”) Continued:
 - BRUCE EX <3 MIN: “completely inadequate”
 - **solutions (B):** pharm scan, definitive cath (MO wgt<450, sev/esCOPD/e), RAPCI
 - BRUCE EX <6 MIN: “inadequacy present”
 - RAPCI: pursue solutions A, then empiric med therapy, then definitive cath

EXCEPTIONS

- ACHILLES HEEL OF ADENOSINE and PERSANTINE Scans: IF RISK/SX/CLINICAL FEATURES ARE OUT OF PROPORTION TO SCAN RESULT (“SMALL” or NEG): MUST HAVE PRETEST PROBABILITY:
- Pre-test Clinical Risk Assessment (CRA):
 - **DM 10/20/EOD**
 - **SM 30/60/90/120**
 - **FMHX <40/<50**
 - **SIGNIF VASCULAR DISEASE: CVODZ, PVODZ, RAD**
 - **VASCULAR DISEASE RISKS: Homocysteine, Lipoprotein a (Lpa)**
- Solution if CRA increased: Do Dobutamine Echo Or Proceed To Cath

PROGNOSIS AND SEVERITY OF CAD

- Duration Of Symptom-limited Exercise: $<S_1, <S_2$ (<6.5 METs)
- Exercise HR ≤ 120 /min at Onset of Limiting Sx, off BB
- Degree of ECG changes:
 - Onset at HR <120 /min (<6.5 METs)
 - Magnitude ≥ 2.0 mm
 - Postexercise duration ≥ 6 min
 - Number of ECG leads involved
- Systolic BP During or Following Exercise:
 - Flat BP Response (≤ 130 MmHg), or Sustained Decrease SBP > 10 MmHg
- Other:
 - ST Elevation (Other Than aVR)
 - Typical Angina Pectoris During Exercise
 - Exercise-induced Ventricular Tachycardia
 - Exercise-induced U Wave Inversion

CONTRAINDICATIONS

- Absolute:
 - Acute MI
 - Unstable Angina
 - Cardiac Arrhythmias
 - Acute Pericarditis
 - Endocarditis
 - Severe Aortic Stenosis
 - Severe LV Dysfunction
 - Acute Pulmonary Embolus
 - Serious Non Cardiac D/O
- Relative:
 - Signif Systolic HTN
 - Signif Pulmonary HTN
 - Tachy/Brady Arrhythmias
 - Moderate Valvular HD
 - Moderate CDMP
 - LM CAD or Equivalent
 - Hypertrophic CDMP
 - Drug Effect/Electrolyte Abn
 - Psychiatric Disease

CARDIOLOGY CONSULT WHEN: HISTORICAL FINDINGS

- New ECG changes suggestive of ACS (USA, AMI)
- CHF class 3 or class 4
- New S3
- New Heart Murmur (esp diastolic)
- Evidence of Endocarditis, or Prosthetic Valve Endocarditis
- Scenario of SCD, or Syncope with personal injury
- “Brown outs”

CARDIOLOGY CONSULT WHEN: ETT FINDINGS

- Positive tests
- Negative tests, but persistent symptoms
- Any of Red Flag Results (urgent consult)
 - Lung uptake, SBP Flat or Falls
 - positive <S1, <S2, <6.5METs
 - ST elevation from normal baseline
 - Ventricular tachycardia, Ventricular fibrillation
- Other important Arrhythmias induced
- Clarification of results and relation to clinical setting

CARDIOLOGY CONSULT WHEN: ECHO FINDINGS

- Suggestive or definite Endocarditis
- EF <35%, progressive decline in EF over 1 year >10%
- New anterior wall motion abnormality
- Valvular Heart Disease: =/> mild AI, =/> moderate MR
- Pulmonary HTN =/> 50 mmHg
- New RV enlargement, RV dysfunction
- Pericardial effusions

CARDIOLOGY CONSULT WHEN: HOLTER/EVM FINDINGS

- Appropriate Clinical History
 - Syncope, LH, DIZ, “Brown Outs”, Palpitations, ASCVDZ, VHDZ
 - patient on anti-arrhythmics
- Brady / Tachy Arrhythmias
 - Sick Sinus Syndrome
 - SVTs
 - AV blocks / Junctional rhythms
- Ventricular Arrhythmias
 - repetitive, sustained, frequent (PVCs)
 - ventricular tachycardia, ventricular fibrillation

**RENAL ARTERY DISEASE
AND RENOVASCULAR
HYPERTENSION:
HANDOUT FOR REVIEW**

**PERIPHERAL VASCULAR
DISEASE AND
ENDOVASCULAR
INTERVENTIONS:
HANDOUT FOR REVIEW**