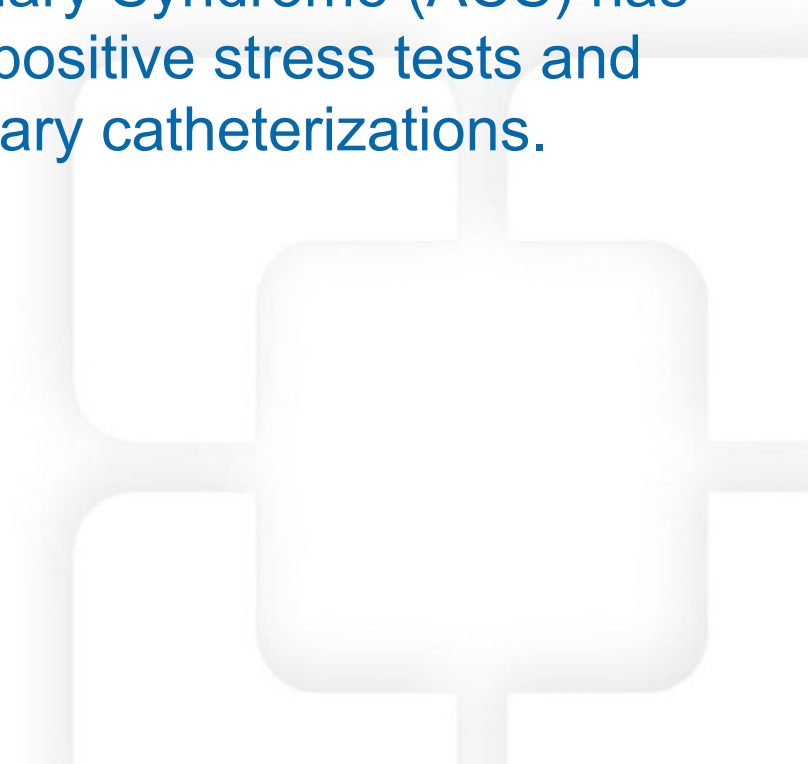


Does admission of low risk chest pain patients lead to unnecessary coronary angiography?

Preventing Overdiagnosis 9/21/2016

**Amy Canada MD, Merritt Huber MD, Steve Zyzanski PhD, Aaron Lear MD
Cleveland Clinic Akron General Family Medicine**

Hypothesis: Admission of low risk patients for evaluation of chest pain/rule out Acute Coronary Syndrome (ACS) has led to a high proportion of false positive stress tests and subject patients to unnecessary catheterizations.



Background

- Academic family medicine residency program
- We noticed ‘cookbooking’ of low risk chest pain patients
 - Admission for chest pain/stress test becoming one in the same
- Set out to evaluate the course of these patients
 - Preventing Overdiagnosis 2014 Oxford Poster

Recommendations



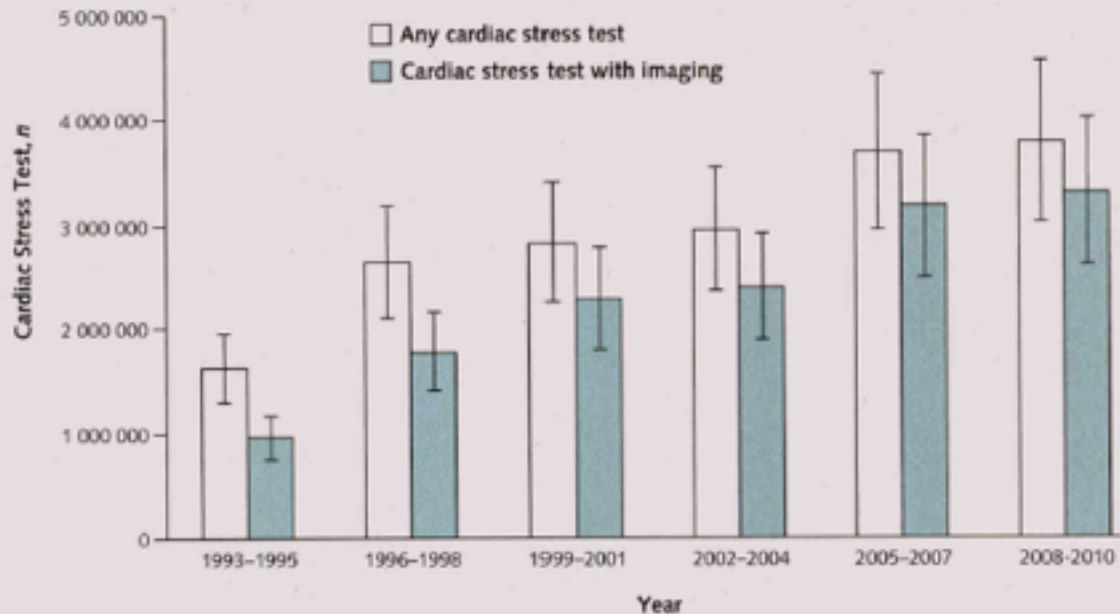
Recommendations

If the patient is low risk and does not experience any further ischemic discomfort and a follow-up 12-lead ECG and cardiac biomarker measurements after 6 to 8 h of observation are normal the patient may be considered for an early stress test to provoke ischemia or CCTA to assess for obstructive CAD.

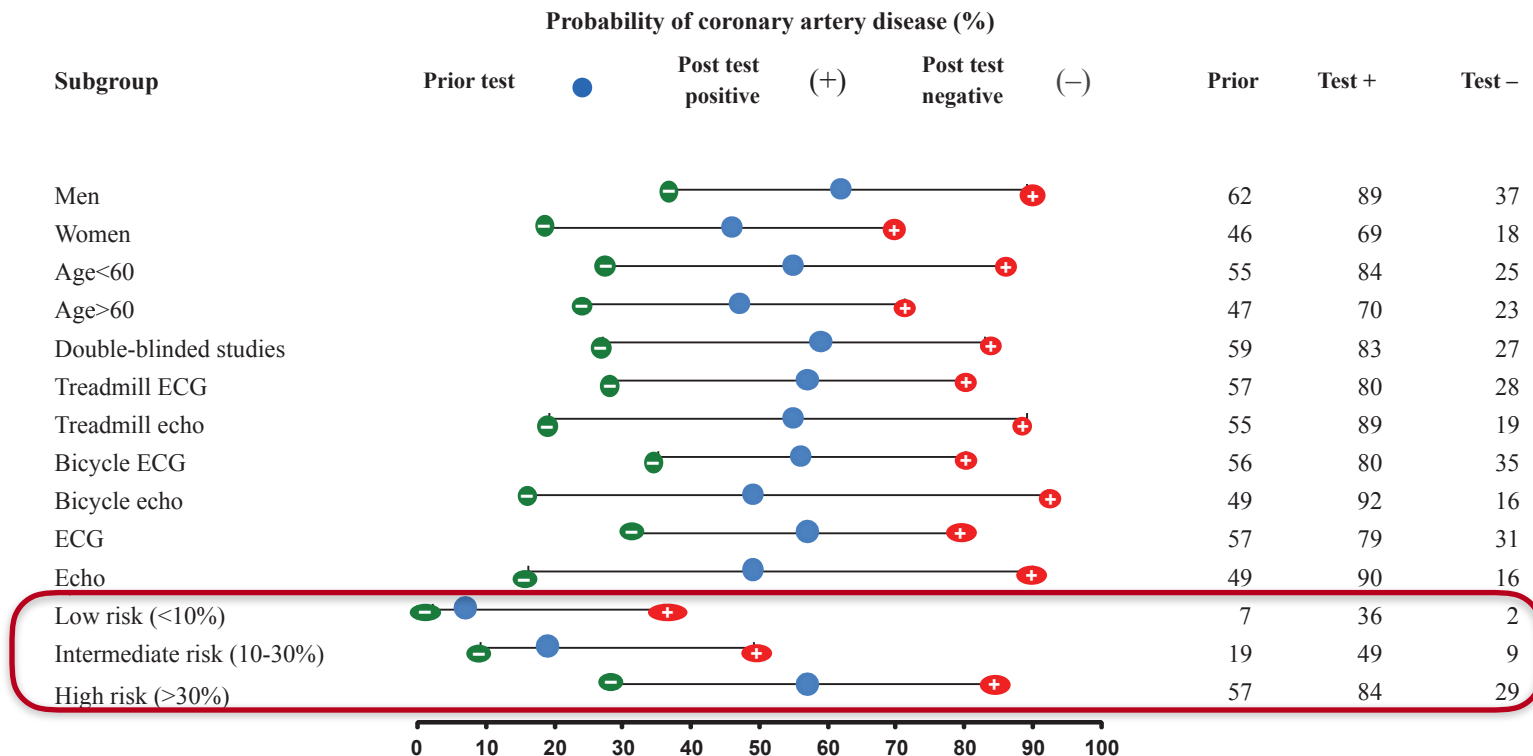
This test can be performed before the discharge and should be supervised by an experienced physician. Alternatively, the patient may be discharged and return for stress testing as an outpatient within 72 h.

Increasing Volume of Stress Tests Nationally in US

Figure 1. Number of cardiac stress tests ordered or performed for adults without coronary heart disease in U.S. ambulatory care visits, 1993–2010.



How Accurate are Stress Tests Anyhow?



The probability of CAD before testing is shown with the blue dots, the error bars show the change in probability with a red positive sign for a positive stress test and a negative green sign for a negative stress test.

Figure 2 Subgroup analysis of probability of coronary artery disease pre- and post-exercise testing

Methods

- Design: 6 month retrospective chart review
- Subjects:
 - Patients between 30-70 yo (valid Duke score ages)
 - No hx of CAD
 - Low risk (no evidence ACS in ED)
 - Admission dx: chest pain, chest pressure, chest heaviness, and chest pain cardiac

Methods

- Data:
 - Medical Hx
 - Serum lab values/ECG
 - Stress test/Results
 - Coronary angiography
- Retro-actively apply the Duke Score¹ for coronary artery disease
 - Evaluation of pretest probability

1. Pryor, D. et. al. Estimating the likelihood of significant coronary artery disease. Amer J Med 1983; 75: 771-780

Methods

- Analysis
 - Is there a difference in how low risk vs. moderate and high risk patients treated?
 - Is there a difference in stress and angiography results of low risk vs. moderate and high risk patients?
 - False Positives, Positive Predictive Value
 - Sensitivity, Specificity, Likelihood ratio?

Demographics

Total	544 (100.0%)
30 – 44 Years	122 (22.5%)
45 – 65 Years	381 (70.0%)
> 65 Years	41 (7.5%)
Males	226 (41.5%)
Females	318 (58.5%)
Hypertension	322 (59.2%)
Diabetes	134 (24.6%)
Hypercholesterolemia	182 (33.5%)
Obesity (> 30 BMI)	274 (50.4%)
Smokers	277 (51.0%)

Stress and Angiography Results

Testing Results by DCS Risk

DCS	N	Stressed	Positive or Inconclusive Stress Tests	Positive Cath or CT/ Positive or Inconclusive Stress Test
Low	306	154/306 (50.33%)	27/154 (16.88%)	1/17 (6.7%)
Moderate/ High	177	120/238 (50.4%)	32/121 (26.4%)	14/29 (48.3%)
Total	544	275/544 (50.6%)	59/276 (21.4%)	15/46 (32.6%)
RR Low/MH (95% CI)		0.995 (0.839, 1.181)	0.659 (0.418, 1.037)	0.122 (0.018, 0.573)

*Single positive low risk catheterization patient had NSTEMI

False Positives/Positive Predictive Value Stress Tests

- **Low risk**
 - PPV Stress test: $0/16=0\%$
 - False Positive: $16/16=100\%$
- **Moderate/High Risk**
 - PPV: $14/29=48\%$
 - False Positives: $15/29=52\%$

Sensitivity/Specificity/Likelihood Ratios

- **Difficult to Report without way to measure True positive/True negative**
- **No Gold standard testing in this cases**

Low risk	Stress Positive	Stress negative	total
cath positive	1	?	1
cath negative	16	?	16
Total	17	?	17

Mod/High risk	Stress Positive	Stress negative	total
cath positive	14	?	14
cath negative	15	?	15
Total	29	?	29

Discussion

- Every patient catheterized with low pre-test probability negative result
- What we thought we were seeing was true
- Only about 50% of admitted were stress tested
- Not all positive stress tests received angiography-unsure why
- 46/59 positive/inconclusive stress tests->angiography

Discussion

- No difference in those stress tested
 - Low risk=Moderate/High Risk
- Should we evaluate pre-test probability?
- Do we kick the can down the road for liability?
 - ED->admitting Dr.->Cardiologist
 - Who says no need to evaluate?

Limitations

- **Retrospective**
- **Did not expect the low number of stress tests**
 - **Did not collect data on why only half got stress tests**
 - **Had they recently been admitted?**
 - **Previous outpatient stress tests?**
- **Did not plan our study with statistician-leading to limitation of our analysis**

Future of Acute Coronary Syndrome at the Hospital

- High Sensitivity Troponins (1 hour rule out)
- 3 hour rule out for low risk with lower sensitivity testing
- Who is responsible for critical evaluation of need for stress test?
- Is there a role for stress tests in stable, low risk hospitalized patients?

Reimbursement Associated with Low Risk Chest Pain (US Medicare data)

- ED->Observation (no stress): \$2575
- ED->Obs (with stress): \$2575
- ED->Obs, Stress and Cath: \$3579 (min)
- ED->Obs, No Stress and Cath: \$3579 (min)
- ED visit and discharge \$922.00
 - New Pt Office Visit: \$322
 - OP Stress: \$1140.54
 - Total: \$2384.54
- Most Lucrative: Observation, then OP stress

Acknowledgements

- **Evan Bosman, BS**
- **Jessica Robertson, BS**
- **Kevin Baldie, MD**
- **Asim Bhatti, MD**

References

- American Heart Association Statement 2010: Testing of Low-Risk Patients Presenting to the Emergency Department With Chest Pain.
- American College of Cardiology/American Heart Association Statement 2007: Guidelines for the Management of Patients With Unstable Angina/Non–ST-Elevation Myocardial Infarction
- Ladapo., J., et. al. Trends in the Use of Stress Testing to Diagnose Coronary Heart Disease. *Ann Intern Med*, 2014;161:482-490.
- Banerjee, et al. Diagnostic accuracy of exercise stress testing for coronary artery disease: a systematic review and meta-analysis of prospective studies. *Int J Clin Pract*, May 2012; 66(5): 477–492
- Pryor, D. et. al. Estimating the likelihood of significant coronary artery disease. *Amer J Med* 1983; 75: 771-780



Cleveland Clinic

Every life deserves world class care.