Women, Cardiovascular Disease and Medical Errors

James Feldman MD MPH FACEP
MMS 8th Annual
Women’s Cardiac Conference
Feb 1, 2013

Diagnostic Errors—The Next Frontier for Patient Safety

David F. Newman-Toker, MD, PhD
Peter J. Pronovost, MD, PhD

An estimated 40,000 to 90,000 US hospital deaths result from misdiagnosis annually. Roughly 2% of autopsies reveal lethal diagnostic errors for which a correct diagnosis...
Medical Errors and Emergency Medicine: Will the Difficult Questions Be Asked, and Answered?

Missed Acute Cardiac Ischemia in the ED: Limitations of Diagnostic Testing

REENA DUJEJA, MD AND JAMES A. FELDMAN, MD

AMERICAN JOURNAL OF EMERGENCY MEDICINE • Volume 02, Number 03 • May 2004

The NEW ENGLAND JOURNAL OF MEDICINE

Physician Variability in History Taking When Evaluating Patients Presenting with Chest Pain in the Emergency Department

Thely L. James, MD, James Feldman, MD, Supriya D. Mehta, PhD

ACADEMIC EMERGENCY MEDICINE 2006: 0197-02 © 2006 by the Society for Academic Emergency Medicine

Table 3
Results of Multivariate Logistic Regression: Association of Race and History Questions, Controlling for Age

<table>
<thead>
<tr>
<th></th>
<th>OR</th>
<th>95% CI</th>
</tr>
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<tbody>
<tr>
<td>Physician asked about smoking</td>
<td>0.95</td>
<td>0.92, 0.97</td>
</tr>
<tr>
<td>Nonwhite race</td>
<td>2.70</td>
<td>1.26, 6.19</td>
</tr>
<tr>
<td>Physician asked about alcohol use</td>
<td>0.96</td>
<td>0.95, 0.98</td>
</tr>
<tr>
<td>Nonwhite race</td>
<td>2.49</td>
<td>1.50, 4.12</td>
</tr>
<tr>
<td>Physician asked about alcohol use</td>
<td>0.98</td>
<td>0.96, 0.99</td>
</tr>
<tr>
<td>Nonwhite race</td>
<td>1.77</td>
<td>1.01, 3.09</td>
</tr>
</tbody>
</table>

This table represents three different models: Being asked about smoking, alcohol use, and alcohol are the outcomes. The reference category for race is “white.”
Outline for the Workshop

• Case based format
  – What happened?
  – Why did it happen?
  – What can be done about it?

• Discuss
  – Gender based differences in presentation
  – Physician based differences in evaluation
  – Prevention strategies
Case 1

• 46 yo female
  – Shortness of breath, cough
  – Triage RN note “chest pain”
  – MD CC: “Request antibiotics for bronchitis”
  – Tobacco, HTN, Postmenopausal
  – Treated albuterol, discharge azithromycin
  – Diagnosis “Bronchitis, Reactive Airway Disease”

Case 1:
48 Hour Return

• Reports to co-workers “worsening chest pain”
• Leaves work to go home
• Arrives in triage complaining of CP and SOB
  – VF arrest witnessed
  – ECG
Case 1:
Outcome

- Cath: LAD tubular 90% stenosis secondary to CAD dissection
- Stent to 10%
- Initial CK 75 trop 0.8
  - Peak CK 608
- ECHO 30% apical akinesis
- D/C Clopidogrel, Captopril, NTG
Questions

• What happened?
• Why did it happen?
• What can be done about it?

Case 2
CC “Nerves” (ED triage RN)
• RN History:
  • 58 yo Spanish speaking female
  • Patient arrives via EMS- found on floor of house- refusing to speak and fluttering eyes.
  • Had a fight at house with grandson
  • Called rest of family and stated she needed to go to the hospital because she was 'nervous'.
Case 2: ED Note

**Resident:**
- CC: Patient presents for the evaluation of mental status changes, lethargy.
- Onset of symptoms reported as gradual, just prior to presentation
- QUALITY lethargy, disorientation
- ASSOCIATED WITH chest pain
- Patient was having a discussion with her grandson, when started to have chest tightness, not answering questions, found on the floor by daughter
- PMH: HTN, hyperlipidemia on diet, depression

Case 2

**ED Attending:**
- Chest pain after verbal altercation with family. Now with squeezing pain.
- No shortness of breath. No palpitations. PE: negative
- EKG: No evidence of acute ischemia.
- Admitted to Telemetry for Chest Pain
Case 2: Hospital Course

- Normal EKG and biomarkers
- Noninvasive testing- adenosine nuclear scan:
  - Stress ECG:
    - No ischemic ST segment depressions during adenosine infusion or recovery.
    - Stress Test Interpretation:
- Pharmacologic test
  - Elicited chest heaviness during adenosine infusion negative for ischemic EKG changes.
- Summary of Nuclear Findings: No perfusion defects.
  - Gated imaging shows LVEF 68% with no wall motion abnormalities.

- Conclusions:
  - Pharmacologic nuclear stress test negative for inducible ischemia.
- Discharge diagnosis= Atypical Chest Pain

DISCUSSION?
Case 2: Return Visit

- 59 y/o female w/HL, HTN w/o other CAD CRF
- *With negative stress test 1 yr ago*
- 20 min episode chest pressure after argument with family
- + H/O same with arguments with family
- No hx of same with exertion
- In ED pt w/EKG not diagnostic for acute ischemia
- *Imp non-cardiac chest pain*
- *Diagnosis: Anxiety reaction, chest pain*

Medical Reasoning

**Plan:**
Will not draw labs as will not aid in diagnosis.

Will d/c home with urgent PCP re-evaluation.

Pt aware of the above and agrees with plan.

She does not feel depressed and feels safe at home.

She will contact her PCP in the next 1-2 days and RTED for any progression of worrisome symptoms.
Decision Analysis

• Angina triggers
• Depression history
• Atypical pain history
• Data:
  – EKG not ischemic
  – ETT mibi 1 yr negative

Return Visit

• Returns to ED 12 hours later

• Complaining of chest pain
Questions

• What happened?

• Why did it happen?

• What can be done about it?
Case 3

- 19 yo woman c/o chest pain x 3 hrs
- Onset running to bus
- Severe substernal radiating to left shoulder
- Relief with NTG
- CRF cigarettes, no drugs, no FHx clotting
Hospital Course

• Initial troponin negative
• Diagnosis = **Pericarditis**
• 8 hr troponin= 28
• Transfer to CCU
• Cardiac cath= RCA thrombus

**ST Elevation Myocardial Infarction in Young Adult Females**
doi: 10.1097/SMJ.0b013e31819c9bbc

Questions

• What happened?

• Why did it happen?

• What can be done about it?
Case 1: What happened?

Gender differences in ACS

Women are less likely than men to experience chest pain

More likely to experience nausea and vomiting

Less likely to have these complaints and symptoms recognized as caused by ACS

Case 2: Bias

- 8 simulated cases
- 2 non-identical cases read by 253 primary-care physicians
- 25% believed women were likely to make excessive demands on physician time, although only 14% believed this likely of men (p < 0.01)
- Women's complaints were judged more likely to be influenced by emotional factors (65% vs 51%, p < 0.01)
- Were identified as psychosomatic more frequently than were men's (21% vs 9%, p < 0.01).
Race and gender affected referral for cardiac catheterization

Knowledge Gaps

Women ≠ Men
Gender CVD Differences: CAD Dissection

- 1931 first report
  - 42 yo ♀ autopsy
  - 82% Mayo series
- 18% postpartum
- Fibromuscular dysplasia?

Gender CVD Differences: Takotsubo

- TTC cardiomyopathy
  - 91% (296/324) women (age 68 ± 12)

Gender CVD Differences: CAS spasm

- CAS
  - Prinzmetal’s variant angina
    - tend to be younger
    - female subjects
    - usually do not have traditional cardiovascular risk factors except smoking

Depression and Coronary Heart Disease

AHA Science Advisory

Most studies … have shown a dose-response relationship, with more severe depression associated with earlier and more severe cardiac events.

...Depression remains associated with at least a doubling in risk of cardiac events over 1 to 2 years after an MI.
Post-menopausal women are at significant risk for coronary artery disease

Increased rates of depression compared to their male counterparts and often present atypically with coronary insufficiency.

Because depression is an independent risk factor for acute coronary syndrome and there is great overlap between symptoms of depression and coronary ischemia, clinicians must be exceedingly cautious in evaluating older women presenting with atypical complaints, particularly if they suffer from depression.

Symptoms attributed to sadness, anxiety, or lack of social support may be anginal equivalents.
**Women ≠ Men Angina**

- **Paradox**
  - Women ↑ prevalence angina vs men, yet ↓ prevalence of obstructive CAD
  
  - *Symptomatic* women cath less extensive and severe obstructive CAD despite being older with ↑ CRF factor burden vs men
  
  - Despite ↓ obstructive CAD, women have a *more adverse prognosis* vs men
Women’s Ischemia Syndrome Evaluation (WISE Study)

1. Traditional tests obstructive lesions less helpful in women
2. Traditional signs/symptoms more complex
3. Gender-specific pathophysiology exists needs more study (ie. estrogen & CRP)
4. Non-obstructive ischemic CAD exists & is significant for women


Case 3

- CRF = 4 month patch norelgestromin and ethinyl estradiol + smoking
- OCP/other contraceptive not routinely in Medication list EMR
- MD often forget to ask
  - HA
  - Chest pain
  - SOB
ED Pharmacist Comments

• Documentation of home medications in EMR is poor at best.
• Many available OCP products with varying degrees of estrogens and progestin’s which can be confusing for the patient and providers.
• When the nurses are entering pt home meds there is a check box for Birth Control Pills – name unknown, that would at least provide documentation of OCP use, but I’m not sure how often this is used.
• Many times patients on OCPs do not consider this a home medication unless directly asked if they are using them.
• When obtaining a home med list it is likely often missed. Asking about OCP use separately can reinforce to the patient that these are medications that can come with adverse effects.
• On a personal note I have seen 2 teenagers have strokes while on the patch some years ago. I don’t remember the specifics of each case but many things can alter drug delivery through a patch, the most common one being heat.

Solutions?

It's always darkest just before it goes pitch black.

Jay@thezenofsouthpark.com
Strategies to Avoid Diagnostic Errors

• **Knowledge**
  – Improved clinical decision making

• **Training**
  – Metacognition

Knowledge

• Use Bayesian approach

\[
P(h | D) = \frac{P(D | h)P(h)}{P(D)}
\]

- \(P(h | D)\) = posterior probability of \(h\)
- \(P(h)\) = prior probability of \(h\)
- \(P(D | h)\) = probability of observing \(D\) given that \(h\) holds
- \(P(D)\) = probability of observing \(D\)
Bayes' Theorem

• Bayes' theorem (1763) relationship between
  – Prior probability of disease
  – Test characteristics (sensitivity, specificity)
  – Test results (post test probability)
• Helps understand test result in clinical context
• Treat patient, not test-why?

Figure C. Summary of accuracy of NITs compared with coronary angiography for diagnosing CAD in women with no known CAD (all studies)
Left Main Trunk Coronary Artery Dissection as a Consequence of Inaccurate Coronary Computed Tomographic Angiography

A 52-year-old woman presented to a community hospital with atypical chest pain. Her low-density lipoprotein cholesterol and high-sensitivity C-reactive protein levels were not elevated. She underwent cardiac computed tomography angiography, which showed both calcified and noncalcified coronary plaques in several locations. Her physicians subsequently performed coronary angiography, which was complicated by dissection of the left main coronary artery, requiring emergency coronary artery bypass graft surgery. Her subsequent clinical course was complicated, but eventually she required orthotopic heart transplantation for refractory heart failure. This case illustrates the hazards of the inappropriate use of cardiac computed tomography angiography in low-risk patients and emphasizes the need for restraint in applying this new technology to the evaluation of patients with atypical chest pain.

Published online December 13, 2010.
### Strategies to Avoid Diagnostic Errors

- **Training**

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**Table. Test Characteristics for a Hypothetical Cohort of 1000 Patients Presenting With Symptoms Suggestive of Coronary Artery Disease**

<table>
<thead>
<tr>
<th>CAD Prevalence, %</th>
<th>CTA Specificity, %</th>
<th>CTA Sensitivity, %</th>
<th>TP</th>
<th>FP</th>
<th>TN</th>
<th>FN</th>
<th>PPV, %</th>
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<td>730</td>
<td>185</td>
<td>100</td>
<td>96</td>
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**Figure Legend:**
Test Characteristics for a Hypothetical Cohort of 1000 Patients Presenting With Symptoms Suggestive of Coronary Artery Disease

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Abbreviations: CAD, coronary artery disease; CTA, cardiac computed tomographic angiography; FN, false negative; FP, false positive; NPV, negative predictive value; PPV, positive predictive value; TN, true negative; TP, true positive.

* In this 1000-patient cohort, CAD prevalence equals to the clinical suspicion, or pretest probability, of CAD in the individual patient.
Metacognition

- **Metacognition** = knowledge (i.e. awareness) of one's **cognitive processes** and the efficient use of this **self-awareness** to self-regulate these cognitive processes.
Other interventions

• Simulation

• Feedback

• Diversity
Summary

• Women and CVD
  – Source of Diagnostic errors
  – Provider and patient level factors
  – Opportunities to reduce diagnostic errors
    • Knowledge
    • Training
    • Other interventions
The Yentl syndrome is alive and well

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