Considering Key Components of Clinical Diagnosis

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Disclosures

• I have no financial or non-financial conflicts of interest

• However, I do sport a southwestern drawl honed in West Texas ...

• My passion past 30yrs: Create learning opportunities for resident/fellow physicians to be better than their faculty
Raygun
Unpaid Advertisement

IOWA:
WAVE THE NEXT TIME
YOU FLY OVER

IOWA CITY:
ALL OUR
CREATIVITY
WENT INTO THE NAME.

ACTUALLY, WE’RE JUST
OUTSIDE THE MIDDLE
OF NOWHERE.
Wagons from Kocs, Hungary
Today’s Road Map Objectives

• Inspire us to explore – & pursue mastery – in clinical diagnosis

• Practice Simple Math & English
• Practice *Avoiding* Formulas
• Enjoy Fun Interaction
A Case for Demystifying Clinical Diagnosis for (Ourselves) & Our Learners
A 45 year old female ... 

Presents to ER c/o severe upper abdominal pain & N/V

- Pain is diffuse, 6/10 non-radiating
- Family reports pain started after 2 days of binge drinking
- PMH significant for 2 prior ETOH-related admissions (Inebriation with N/V)

Exam:
- Afeb BP 150/90, RR18, Pulse 100
- Inebriated and in mild distress due to abd pain
- Moderate diffuse abd tenderness, no rigidity, guarding, or rebound
A 45 year old female …

Labs are ordered:
- Serum ethanol – 110 mg/dl
- CBC – Hct 31; Hb 11.0; WBC 13,000; plat 180,000
- Amylase 380; lipase 40; LFTs nl
- Abdominal Xray – No abnormalities

Think Out Loud with Me
A 45 year old female …

She’s admitted to Internal Medicine
Diagnosis – Alcoholic Pancreatitis

• Kept NPO
• IV pain meds and IV fluids started
• Monitored on ETOH withdrawal scale
A 45 year old female ...

CT scan of the abdomen: Ruptured ectopic pregnancy!
What Happened!!!

Why was the ectopic pregnancy misdiagnosed?

• Clouded sensorium & reported pain was epigastric

• We loved our initial (mis)diagnosis

• Low suspicion for pregnancy in a 45y/o

• Therefore NO suspicion for ectopic pregnancy
What Types of Diagnostic Information Could Help Minimize Diagnostic Error?

- Background info on ectopic pregnancy
- Clinical presentation of ruptured ectopic pregnancy (clinical manifestations)
- Disease probability for differential diagnosis
- Risk factors for rupture
- Is there a clinical prediction rule to estimate risk for ectopic pregnancy or rupture??? (nope)
Humbling ... Minimal Found

TRUTH

<table>
<thead>
<tr>
<th></th>
<th>Ruptured Ectopic</th>
<th>Non-Ruptured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemoperitoneum+</td>
<td>66%</td>
<td></td>
</tr>
<tr>
<td>Hemoperitoneum-</td>
<td>34%</td>
<td></td>
</tr>
</tbody>
</table>

Only Ruptured Patients

When Considering Ddx

Is Differential Diagnosis ... a List or an Active Process?

<table>
<thead>
<tr>
<th></th>
<th>‘Possibilistic’ List</th>
<th>‘Probabalistic’ Reasoning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physician Effort</strong></td>
<td>Memorize all possibilities</td>
<td>Thoughtfully &amp; sequentially regard the list based on ...</td>
</tr>
</tbody>
</table>
| **Type of Thinking** | Consider all known causes | Actively reorder list based on:  
  • Patient Context  
  • Probabilistic  
  • Prognostic  
  • Pragmatic |
Intersection of Diagnosis & Therapy
Probabilities & Thresholds

Probability of Diagnosis

- 0% Test threshold
- Probability below test threshold: no testing warranted
- Probability between test and treatment threshold: further testing required
- Probability above treatment threshold: testing completed; treatment commences
- 100% Treatment threshold

## Why Testing Threshold Slides

<table>
<thead>
<tr>
<th>Factor</th>
<th>Lowers Test Threshold</th>
<th>Raises Test Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prognosis of Disorder</td>
<td>Serious if left undiagnosed</td>
<td>Less serious if missed</td>
</tr>
<tr>
<td>Effectiveness of Rx</td>
<td>Treatment is effective</td>
<td>Treatment is less effective</td>
</tr>
<tr>
<td>Test Safety</td>
<td>Low or zero-risk test</td>
<td>Higher risk (e.g. invasive)</td>
</tr>
<tr>
<td>Test Cost</td>
<td>Low cost</td>
<td>Higher cost</td>
</tr>
<tr>
<td>Test Acceptability to Patients</td>
<td>High acceptability</td>
<td>Lower acceptability</td>
</tr>
</tbody>
</table>
The 2 x 2 Table

<table>
<thead>
<tr>
<th>TRUTH ($D_z$)</th>
<th>Present</th>
<th>Absent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pos</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neg</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dx Test

From what perspective do Docs get to gaze into this box?
# The 2x2 Table

**Neurohormone SAD levels in 200 dazed Cleveland Cavalier Fans (Down 3-0)**

<table>
<thead>
<tr>
<th>Depression</th>
<th>Present</th>
<th>Absent</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;150</td>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td>≤150</td>
<td>40</td>
<td>105</td>
</tr>
</tbody>
</table>

SAD Level
# The 2 X 2 Table

Neurohormone SAD levels in 200 dazed Cleveland Cavalier Fans (Down 3-0)

## Depression

<table>
<thead>
<tr>
<th>SAD Level</th>
<th>Present</th>
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<tbody>
<tr>
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<td>50</td>
<td>5</td>
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<td>≤150</td>
<td>40</td>
<td>105</td>
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</tbody>
</table>

- Sensitivity (Sen) = 50/90 = 56%
- Specificity (Spec) = 105/110 = 95%
- Positive Predictive Value (PPV) = 50/55 = 91%
- Negative Predictive Value (NPV) =
Neurohormone SAD levels in 200 dazed Midwest folk hungering for Spring

<table>
<thead>
<tr>
<th>Depression</th>
<th>Present</th>
<th>Absent</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;150</td>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td>100-150</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>&lt;100</td>
<td>15</td>
<td>85</td>
</tr>
</tbody>
</table>

The 2 X 3 Table
We Need a 2\textsuperscript{nd} Generation Diagnostic Test Performance Measure …

The Noble Likelihood Ratio
<table>
<thead>
<tr>
<th></th>
<th>2003</th>
<th>2007</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Size</td>
<td>119</td>
<td>174</td>
<td>107</td>
</tr>
<tr>
<td>4th Yr Chief</td>
<td>87%</td>
<td>85%</td>
<td>89%</td>
</tr>
<tr>
<td>Univ-Based</td>
<td>56%</td>
<td>56%</td>
<td>56%</td>
</tr>
<tr>
<td>Female</td>
<td>50%</td>
<td>47%</td>
<td>43%</td>
</tr>
<tr>
<td>Subspecialty Plans</td>
<td>67%</td>
<td>75%</td>
<td>67%</td>
</tr>
</tbody>
</table>
## Confident to Explain Concepts

<table>
<thead>
<tr>
<th></th>
<th>2003 (n=119)</th>
<th>2007 (n=174)</th>
<th>2015 (n=107)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Likelihood Ratio</td>
<td>23%</td>
<td>23%</td>
<td>34%</td>
</tr>
<tr>
<td>Relative Risk Reduction</td>
<td>30%</td>
<td>35%</td>
<td>47%</td>
</tr>
<tr>
<td>Absolute Risk Reduction</td>
<td>33%</td>
<td>36%</td>
<td>50%</td>
</tr>
<tr>
<td>Confidence Interval</td>
<td>41%</td>
<td>49%</td>
<td>68%</td>
</tr>
<tr>
<td>Pretest Probability</td>
<td>46%</td>
<td>46%</td>
<td>63%</td>
</tr>
<tr>
<td>Number Needed to Treat</td>
<td>49%</td>
<td>51%</td>
<td>58%</td>
</tr>
</tbody>
</table>
2nd Generation Measure ... LR

(No Formulas; just these 2 tenets)

1. LR$s$ are the *Doctor’s Friend*

2. LR$s$ are just a *Ratio of Likelihoods*
You’re Cranking Out Notes on the Wards …
A Tired Lady:

- 71F, ↑fatigue, ↓exercise tolerance
- Pale conjunctivae
- Cough, sput, fever
- RLL crackles
- Hgb 8.7 g/dL
- Does she have iron deficiency anemia?
What was Helpful that You Could Try in Your Own Teaching?
Mr. Cox – 80y/o

- Exasperated daughter brought to ED because “he hurts all over and can’t hardly move”

- Doctors & PT not helping with his C3-4 spinal stenosis (mod to severe) or known bilat rotator cuff disease

- Hgb 11; Na 126; LFTs nl, but Alb 2.2

- ESR = 120

- RF = 774 IU/ml

- ED also got Anti-CCP = 300U/ml (nl <3)
Mr. Cox – 80y/o

• New Rheum Fellow called by ED …
  “Sounds like he’s got RA; we’ll see him in consult”

• Overnite Admitting Assessment: RA, needs NHP

• **At 7:30am:** Diffuse aches, especially in shoulders and some hips; Fell on ice & broke left humerus; managed with immobilization; Declining, especially past 2months

• Retired machinist for John Deere; Lives alone; HTN; DM; No h/o periodic joint swelling
Mr. Cox – 80y/o

• 40# wt loss past 6mon
daughter wonders maybe: “cause he can’t barely feed himself”

• Difficulty raising hands out of lap; hurts to gently shake hands; some thenar wasting; Dupuytren contracture

• Moderate tenderness across shoulder muscles, but NT with gentle passive ROM; no effusions or warmth

• No other joint warmth, swelling, or chronic changes of RA; DTRs 2+

• We started therapeutic trial 15mg pred/d; CXR; & requested outside cervical MRI
Rheum Evaluation: Believes all from spinal stenosis, rotator cuff, fracture, immobility. Agrees no synovitis, but “worried about the high Anti-CCP so consider starting hydroxychloroquine”. “Doubt PMR.”

Results of Therapeutic Trial of Steroids

- **Next morning:** Best night of sleep in long time. Helped feed self. Participated with PT evaluation
- **Following morning:** bright affect and feeds self; can raise hands to shoulders without pain
- **Following days – while awaiting Rehab placement –** eating like a horse; takes laps in hallways with walker
- Daughter tearfully exclaims: “It’s a miracle”
Mr. Cox – 80y/o

Think Out Loud with Me …

WHY was it so hard for our rheum colleagues to let go of RA?

What aspects of diagnostic reasoning in this case would you teach about?
Mr. Cox – 80y/o

- Anti-CCP has a sensitivity of 58% and specificity of 96%
- LR(+) = 14.5
- Remember LR > 10 Result in large changes in post-test probability

Systematic Review: Accuracy of Anti-CCP for Diagnosing RA
Ann Int Med 2010; 152:456-464
Pre-test probability 1%

Pre-test probability 40%

Post-test probability >90%

Post-test probability ~10%
Wagons from Kocs, Hungary
Coach Etymology

The Word ‘Coach’

Arises from horse-drawn wagons or carriages
- 1830s Oxford
- 1860s Athletic Coaches appeared

• To help take or move someone from where they are to where they want to be
• It’s a guiding process to improve performance
• Focused on specific skills/tasks/capabilities
Key Take Home Messages

1. Various types of research evidence can inform clinical diagnosis
2. Ddx should be an active process
3. Orient 2x2 box; Know Doc’s perspective
4. For Sen/Spec/PPV/NPV … name denominator first
5. LRs are the Doctor’s friend
6. LR are just a ratio of likelihoods
Savor Your EBM Learning & Teaching in Tasty Slices