Learning (& teaching) to think like a clinician

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• The Effective Clinician

• What is a clinician and what does he do? - PubMed - NCBI
Acknowledgements

• Castiglioni, Roy and colleagues – WAR research
• The CPS team
• Groopman, Kahneman, Gladwell, Klein for their books
• Society to improve diagnosis in medicine

A recent patient presentation

• 41-year-old Hispanic man (left Mexico 7 yrs ago) presents with 4 day h/o progressive dyspnea and fevers
• No previous illness
• Clear sputum with occasional blood streaks
• Feels well other than dyspnea
• Denies orthopnea or PND
**Physical Exam**

- T 101 P 140 BP 140/85 RR 22 O₂ sat 91%
- Decreased breath sounds on the right
- Heart exam – tachycardia, no murmurs, rubs or gallops
- No peripheral edema

**Routine labs**

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**CXR**
Diagnosis?

- How would you treat the patient?
- Do you need more information?

Why clinical reasoning

- Kassirer:
  - Academic Medicine July, 2010 “Teaching Clinical Reasoning”
- WAR research
  - Value of attendings sharing their thought processes

Diagnosis is Job #1
Requires thinking

Problem Representation

… early step is the creation of the mental abstraction or “problem representation,” usually as a one-sentence summary defining the specific case in abstract terms


Patient #1

The patient’s story

47-year-old man presents to emergency department with right elbow pain
No PMH, no meds
Went to bed at 10:30 pm, awoke at 2:17 am with severe right elbow pain, hot & exquisitely tender
No previous similar episodes
Arthrocentesis: 140k WBC with no organisms on gram stain
Two problem representations

SENIOR RESIDENT
47-year-old man with a hot, right elbow and pus in the joint.

ATTENDING PHYSICIAN

Two problem representations

SENIOR RESIDENT
47-year-old man with a hot, right elbow and pus in the joint.

ATTENDING PHYSICIAN
47-year-old man with SUDDEN ONSET of a hot, right elbow and pus in the joint, but a negative gram stain.

Illness scripts

- Features present (or absent) to match against our problem representation
- Example – CAP
  - Short duration of sx
  - productive cough
  - fever, sweats &/or rigors
  - abnormal chest exam
  - Compatible CXR
Implications from problem representation

SENIOR RESIDENT

47-year-old man with a hot, right elbow and pus in the joint.

Therefore – septic arthritis

ATTENDING PHYSICIAN

47-year-old man with SUDDEN ONSET of a hot, right elbow and pus in the joint, but a negative gram stain.

Therefore, must consider crystalline arthritis.

Denouement

The patient had pseudogout.
The resident focused solely on the fluid WBC.
He did not believe that crystalline arthritis could cause that high WBC.
The attending focused on the negative gram stain and sudden onset. The WBC did not influence decision making.
Both used system 1, the attending had a more refined illness script.
10/20/2015

Illness patient script #2

56-year-old man admitted for 4 days of progressive dyspnea
Minimal cough – 2 episodes of clear pink tinged sputum
Denies fever, rigors, has felt chilly
No upper respiratory tract symptoms
Routine labs unremarkable
CXR:

Two problem representations

<table>
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<th>EMERGENCY DEPT</th>
<th>INTERNAL MEDICINE TEAM</th>
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<td>56-year-old man with progressive dyspnea and a left upper lobe infiltrate</td>
<td>56-year-old man with progressive dyspnea, but no purulent sputum, no fever and no rigors</td>
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Admission diagnosis

Community acquired pneumonia
Housestaff remained skeptical
proBNP = 900
Echocardiogram order

Echocardiogram results

Left ventricular ejection fraction ~ 30 %
Increased pulmonary artery pressure

Cardiac catheterization

LVEF = 20% with dilated cardiomyopathy
Mild CAD ~ approximately 40% in each artery
Left atrial enlargement
PCWP = 30
PAP = 64/38
Further history & physical

When questioned 36 hours later - patient told us that he had had progressive dyspnea on exertion for at least 2 months
History of hypertension – untreated
Cardiac exam – loud summation gallop

Why such dx errors?

Incomplete data collection – proper history not taken
Radiologist read the X-ray as infiltrate – did not notice the cardiomegaly
Inadequate physical exam skills
Diagnostic inertia

How to avoid such errors

BE SKEPTICAL – do not believe the “label” the patient carries
Ask yourself if the story (problem representation) fits the illness script for the diagnosis
If not – start from the beginning!
The Dual Process theory of cognition
In making diagnoses (really diagnostic decisions) we start with system 1
When we think that system 1 is failing, we resort to system 2
So what do we mean by system 1 and system 2

Dual process theory
System 1 - Experiential
  Intuitive
  Tacit
  Experiential
  Pattern recognition
  Matching against illness script

System 2 - Analysis
  Analytic
  Deliberate
  Rational
  Careful analysis
  Consider a wide differential
50-year-old male veteran presents with chest pain. Sent for stress test, but the lab finds that he has tachycardia. Labs include Calcium of 11.5.

The patient is volume contracted because of 5 liters daily ileostomy losses (colectomy while in service for Crohn’s colitis)

With repeated testing patient consistently has an elevated Calcium

50-year-old man with chest pain, tachycardia, markedly increased ileal output (ileostomy) and an elevated calcium level
System 1 thinking

Many students and residents just guess – usually focus on the hypercalcemia and pick cancer related or hyperparathyroidism – common causes
Unfortunately, they do not develop problem representation
They focus on one lab test, rather than the entire patient

System 2 thinking

This diagnosis is obtuse. Most correct answers come from a careful consideration of the entire differential diagnosis
As one goes through the differential diagnosis, the correct answer (hyperthyroidism) becomes a consideration
Few learners include hyperthyroidism in their initial differential diagnosis
We need system 2 when the correct diagnosis not clear.

Systems 1 & 2

Going back and forth
Most diagnostic decisions represent system 1 thinking
We only move to system 2 when we must
Experts do more with system 1 than can experienced non-experts
System 1 for experts

- Illness scripts with greater granularity
- More attention to “red flags”

A morning report case

41-year-old woman referred to a nephrologist for CKD and acidosis

Takes NSAIDS (OTC) for “arthritis”

Drinks 4 liters of coca cola each day

On 40 mEq KCl daily

Experts

- System I thinking – the pattern makes sense and only need one or two additional pieces of information
Non-experts

- No obvious answer – must develop a careful differential diagnosis
- Takes more time
- Requires more tests

The answer

- Patient drank 4 L because her mouth was so dry
- Urine anion gap was positive
- Urine pH was > 6
- Sjogren’s syndrome with distal RTA

Challenges – Heuristics and Biases

- Kahneman and Tversky
- Skeptical attitude towards expertise and expert judgment
- Focuses more on errors
- Heuristic – shortcuts or “rules of thumb”
- While heuristics often work, they do have risks
Classic heuristics that lead to errors

- Anchoring heuristic – focusing too much on 1 piece of information
  - The synovial fluid WBC in our patient
- Availability heuristic – influenced by the last patient you saw, or a particularly memorable patient
  - My estimate of risk of allopurinol causing TEN
- Premature closure
  - Often related to anchoring heuristic

You have a solution that you like, but you are choosing to ignore anything that you see that doesn't comply with it. – from the Blind Banker – Sherlock Season 1 Episode 2

Now for a different construct

- The Naturalistic Decision Making movement
- Sources of Power – Gary Klein
Naturalistic decision making

How do experts get it right?
Especially high stakes, uncertainty and time pressure
Firefighter studies

Recognition-Primed Decision Making

Approach 1 - use pattern recognition to match the problem representation with an illness script
Experts note “red flags” or discomforts when 1 or more key features do not match
Experts have more completely developed illness scripts

The patient with chest pain

NSTEMI or not: a 59-year-old man with chest pain and troponin elevation
Expert discussant worries about a missing physical finding
Patient has had several strokes previously:
Severe chest pain
 Radiation to left leg
  Low BP
 ST elevation
 Elevated troponin
Recognition-Primed Decision Making

RPD

Approach 1 – use pattern recognition to match the problem representation with an illness script
- Experts note “red flags” or discomforts when 1 or more key features do not match
- Experts have more completely developed illness scripts

Approach 2 – related to hypothesis testing
- Search for missing data
- Example – examine synovial fluid for crystals
- More system 2 – but then reverts to system 1 when data collected

More RPD

Approach 3 – mentally simulate the consequences of adopting the diagnosis
- Klein calls this a “pre-mortem” examination
- Mental simulation can highlight concerns – and sometimes leads to re-evaluation
- Analogous to – what diagnosis can we not afford to miss!

Our chest pain patient

Low BP but no mention of BP in the other arm
Admitting resident describes an early diastolic blowing murmur II/VI
Expert’s “pre-mortem” thinking caused him to worry about anti-coagulation
When a nurse finally gave BP in both arms, the puzzle pieces all fit
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Using the RPD model

82-year-old woman admitted to ICU for an upper GI bleed
Endoscopy showed esophageal ulcer
Transfused and volume repleted
Monday morning transferred to the floor team at 7 am
Rounds start at 7:45 am
Intern briefly sees the patient – reports that she is stable

Basic Metabolic Panels

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The Question

• Why is the bicarbonate 17?
RPD Approach 1

- Calculate normal gap
- Assume metabolic acidosis
- Must switch to “Approach 2” to seek additional information

RPD Approach 2

- Could it be bicarbonate loss?
  - No diarrhea or acetazolamide
- Could it be a renal acidosis?
  - Normal renal function
  - Appeared quickly - distal RTA unlikely
- Could it be dilution acidosis?
  - Literature suggests minimal HCO₃ decreases

RPD Approach 2

- If not a metabolic acidosis?
- Could it be a respiratory alkalosis?
  - Approach 3 - do not want to miss a hypoxic cause for respiratory alkalosis
- Therefore
  - Need ABG and further clinical investigation
Data collection

- Weight gain – 12 lbs since admission
- New small bilateral pleural effusions
- Order pro-BNP
- Examine orders – receiving 200 cc NS per hour

Resolution

- Stopped IV fluids
- Gave one dose of furosemide
- ABG 7.43/29/79/19 on 3 l nasal O₂
- proBNP >4000
- Pt lost 8 pounds and no longer needed nasal oxygen

An example

29-year-old female – fever and cough
CXR
Azithromycin for presumed community acquired pneumonia

Treatment

One week later

No improvement
Admitted to hospital
Treated for CAP with moxifloxacin
CXR
Continued cough and fever
ID consulted
Repeat CXR

2 weeks after discharge
ID consultant
TAKES a good HISTORY

- 2 months of symptoms
- Night sweats
- 9 pound weight loss
- Lives in a recovery home for drug abusers
- Another resident has a bad cough

Errors
Diagnosis = TB

- Anchoring - premature closure
- Incomplete illness script
- Inadequate data collection

Understanding cognition and medical education

- Learners want to learn how and why we make decisions
- Facts are retrievable
- Therefore we must teach diagnostic reasoning every day on rounds, consults and in the clinic
- Wisdom trumps knowledge
What should we be teaching?

Remember that experts have more refined illness scripts and problem representation.

Therefore, we are trying to help our learners know when System 1 is adequate and when to move to System 2.

As learners progress they should spend more time in System 1.

They will get there faster if we are explicit in explaining the clues and cues.

What should you do?

Deliberate practice – keep track of patients – find out what happens to them.

Attend morning reports – think carefully about the diagnostic processes.

Reinforce what you learn about complex patients with focused reading.

Back to our patient

Treated initially for community acquired pneumonia.

No clinical improvement.

ID switched antibiotics 2 times.

10 days later we get these X-rays.
Xrays 10 days later

Comparison of PA films

Other clues
- Hgb slowly decreasing and after 10 days is less than 8
- Patient is expectorating blood
- Iron deficiency anemia
Bronchoscopy result
- Fresh RBC
- BAL RBC 206 million
- BAL WBC 14 million

Urinalysis
- Not originally obtained
- 180 RBC no casts

Audience participation
- What is the new differential diagnosis?
- What errors did we make?
Final diagnosis

- Granulomatosis with polyangiitis

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