Teaching Clinical Reasoning

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Clinical reasoning

The cognitive process necessary to evaluate and manage a patient's medical condition. It involves knowledge, intuition (developed by experience), critical thinking and reflection on the process.

Clinical reasoning is the sum of the thinking and decision-making process associated with clinical practice, it enables clinicians to take the best judged action in a specific patient context

Barrows HS, Tamblyn RM. Problem based learning: Springer 1980
HiggsJ, Jones M. Clinical Reasoning in the Health Professions 3rd ed

Clinical reasoning: metacognition is crucial

Thinking about how you think, while you think, albeit within the limitations of your thinking mind.

Teaching clinical reasoning

One approach:

1 Understand the processes involved in clinical reasoning

2 Recognize your own process of clinical reasoning in real time

3 Be cognizant of predictable pitfalls in clinical reasoning

4 Apply real time strategies to avoid pitfalls in clinical reasoning

5 Make your thinking visible to your learners in real time

6 Personalize your approach

Teaching clinical reasoning

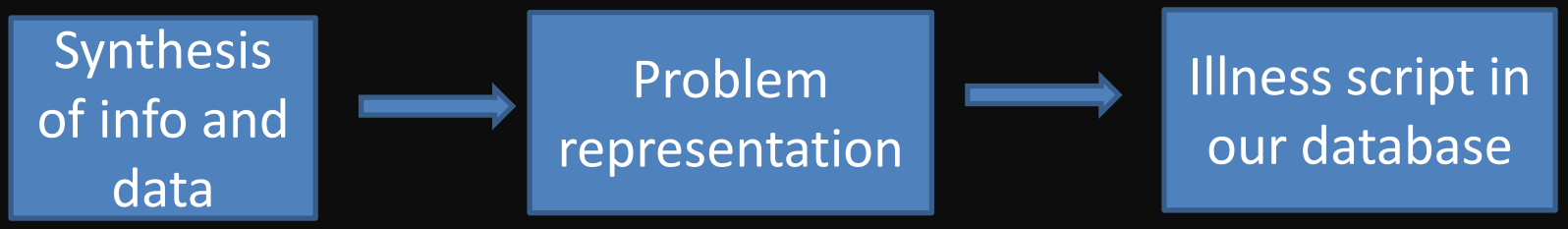
Need to practice, practice, practice and practice!

Need to reflect, reflect, reflect and reflect!

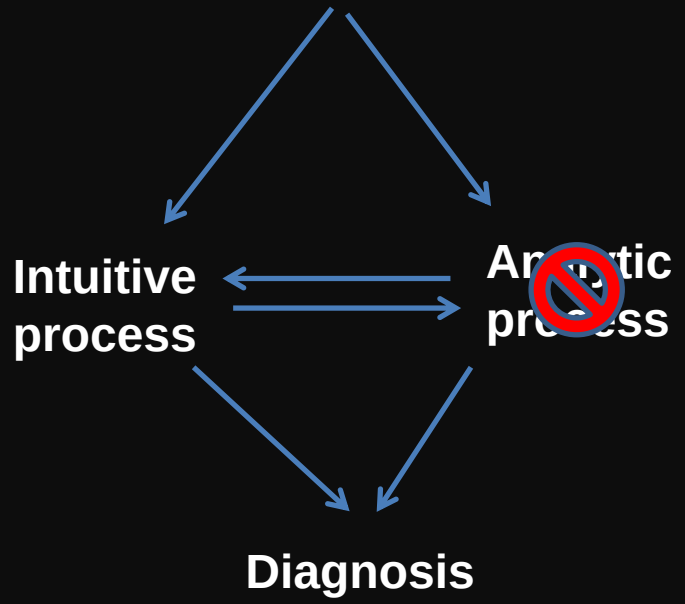
Need to seek constant feedback

You wi
reasoni

Clinical reasoning (CR)



55 yr homeless man presents with 5 weeks of cough, hemoptysis, wt loss, fevers and nights sweats. CXR and CT: bilateral cavitary lesions. Quantiferon + HIV negative



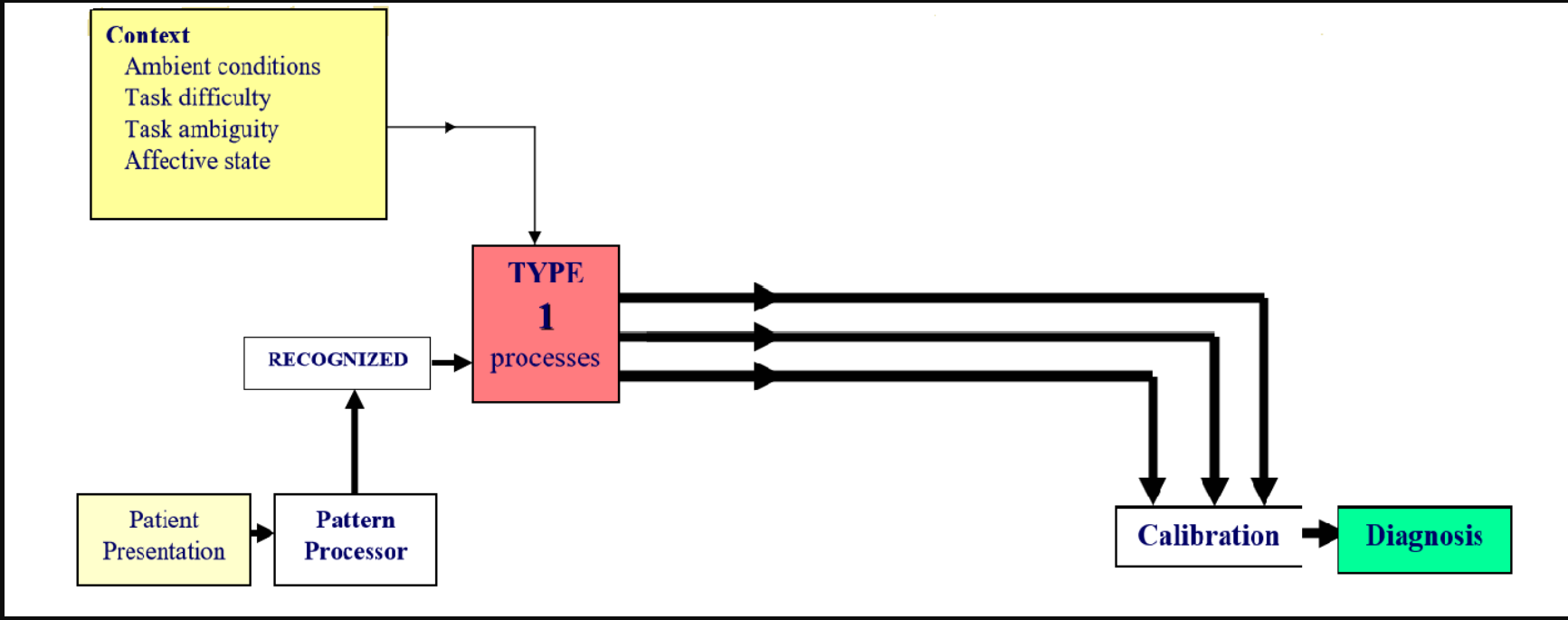
Clinical reasoning (CR)

Dual process theory: 2 cognitive systems involved in reasoning

Intuitive (type 1)	Analytic (type 2)
Reflex system	Deliberate and rational
Experiential – inductive	Hypothetico-deductive
Gestalt	Critical logical thought
Heuristics	Normative reasoning
Low effort	High effort
High emotional attachment	Low emotional attachment
Low cognitive control	High cognitive control
Low scientific rigor	High scientific rigor

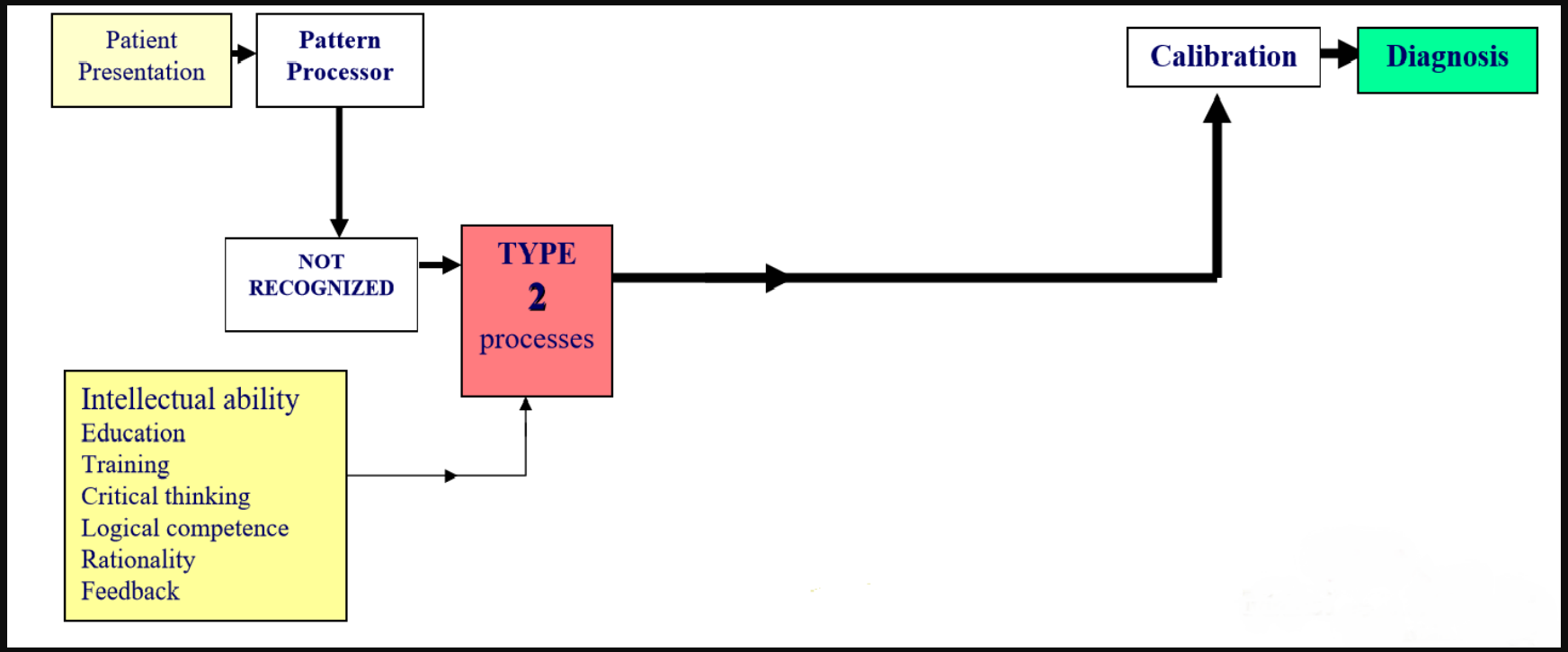
P Croskerry. Academic Med, Aug 2009. K Eva. Medical Education 2004

Clinical reasoning: dual process model



Adapted from P Croskerry. Healthcare Quarterly Vol. 12 2009

Clinical reasoning: dual process model



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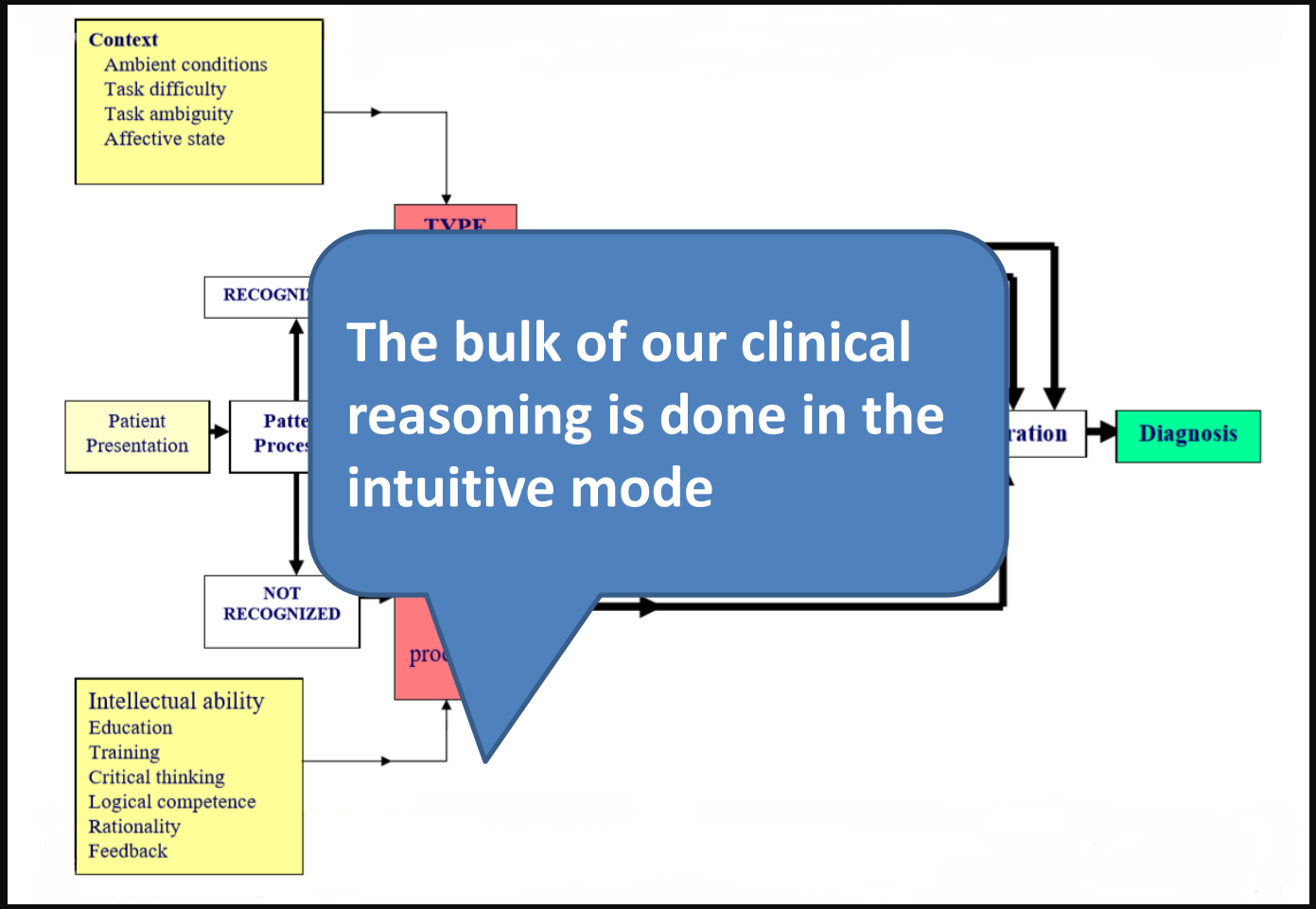
Clinical reasoning: dual process model



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Clinical reasoning (CR)

Dual process theory: 2 (s involved in reasoning

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Heuristics

Heuristics refers to shortcuts in reasoning

Influenced by prior experience

These are typically correct

Prevent extensive deliberation and excessive testing

Produce desired results with minimum delay, cost and anxiety

We spend > 90% of our conscious time in a heuristic mode

Common heuristics

Availability heuristic

- The ease with which a particular idea can be brought to mind

Representativeness heuristic

- Based on similarity to prototype of a category

Anchoring and adjustment heuristic

- Relying heavily on an initial bit of information and all further adjustments are made relative to the "anchor" e.g. buying a car: sticker price is the anchor

Affect heuristic

- Based on feelings (shorter than mood): fear, pleasure, dread

Diagnostic errors: delayed or missed diagnoses

Occur due to pitfalls in clinical reasoning: subconscious biases

We make mistakes when we encounter complex problems

Everyday situations are sufficiently complex to elicit mistakes

Errors occur due to flawed reasoning much more than due to knowledge deficiency

*Surveys of physicians report error rates resulting in serious harm as high as 35 to 40%

* Blendon et al. NEJM 2003

Bias or cognitive disposition to respond (CDR)

Biases are predictable deviations from rationality

CDR is a tendency to react unconsciously to contextual clues that may lead to flawed reasoning

Biases lead to diagnostic errors

Most biases occur in the intuitive type 1 reasoning processes

Biases can only be dealt with by activating type 2 reasoning processes

P Croskerry et al. BMJ Qual Saf 2013

Pitfalls in clinical reasoning

Commonly due to biased judgment and fallacies of heuristics

TABLE 3. Failed Heuristics, Biases, and Cognitive Dispositions to Respond

Aggregate bias	Confirmation bias	Multiple alternatives bias	Posterior probability error	Sutton's slip
Anchoring	Diagnosis momentum	Omission bias	Premature closure	Triage-cueing
Ascertainment bias	Fundamental attribution error	Order effects	Psych-out error	Unpacking principle
Availability and non-availability	Gambler's fallacy	Outcome bias	Representativeness restraint	Vertical line failure
Base-rate neglect	Gender bias	Overconfidence bias	Search satisfying	Visceral bias
Commission bias	Hindsight bias	Playing the odds		Yin-yang out
				Zebra retreat

32 biases and heuristics pitfalls in clinical reasoning

P Crokskerry. Academic Emerg Med. 2002

Cognitive biases: some examples

Blind spot bias

- We believe we are less susceptible to bias than others

Search satisfying

- Calling off a search once something is found

Gamblers fallacy

- Assuming a sequence of diagnosis will not continue

Sunk cost bias

- The more we have invested in a diagnosis, the less we can let go

Triage cueing bias

- AKA geography is destiny: admitted to surgery limits to surgical perspective

Diagnostic momentum

Bandwagon effect

- Group thinking, “that's what they do in CCU”

Visceral bias

- Feelings towards patients impact decisions

Classifications of CDRs in clinical reasoning

Error of overattachment to a particular diagnosis

- Anchoring, confirmation bias, premature closure, sunk costs

Error due to failure to consider alternative diagnoses

- Multiple alternatives bias, representativeness restraint, search satisficing, Sutton's slip

Error due to inheriting someone else's thinking

- Diagnosis momentum, framing effect, ascertainment effect, bandwagon effect

Errors in prevalence perception or estimation

- Availability bias, base-rate neglect, gambler's fallacy,

Classifications of CDR

Errors associated with physician affect, personality, or decision style

- Commission bias, omission bias, outcome bias, visceral bias, overconfidence/ under confidence, vertical line failure, ego bias, sunk costs

Errors involving patient characteristics or presentation context

- Fundamental attribution error, gender bias, psych-out error, triage cueing, contrast effect, yin-yang out

Pitfalls in clinical reasoning: heuristics

Availability	Ease of recalling past cases Subject to base rate neglect
Anchoring	Relying on initial impressions and Ignoring inconsistencies in data Generates **diagnosis momentum**
Framing	Swayed by wording
Blind obedience	Undue deference to authority or technology
Premature closure	Narrow-minded belief in 1 diagnosis

D Redelmeier. Cognitive Psychology of Missed Diagnosis Ann Intern Med 2005

Pitfalls in clinical reasoning: biases

Representative bias	Inclination to estimate probability based on how well it fits the typical characteristics of a category than on the true base rate of that category
Overconfidence bias	Over reliance on self or experts opinion
Confirmation bias	Focus on data that supports our expectations and ignoring conflicting data
Illusory correlation bias	Thinking events are causally related, when in fact the connection is coincidental
Hassle bias	Tendency to take the easy way out

Jill Klien. BMJ Volume 330, 2005

Back to the patient . . .

Pitfalls in clinical reasoning: heuristics

55 yr homeless man presents with 5 weeks of cough, hemoptysis, weight loss, fevers and nights sweats. Quantiferon + CXR and CT: bilateral cavities, HIV negative

Plan:

Isolated, AFB x 3 negative, fungal culture and cytology -ve

Availability

Plan:

BAL AFB -ve, fungal stains and culture negative

Premature closure

Plan:

ATB meds, seen in clinic 7 weeks later: "doing ok" cultures –ve for TB

Anchoring

Plan:

Seen in clinic 12 weeks later, hematuria, pyuria

Illusory correlation
Confirmation bias
Diagnostic momentum

Plan:

Diagnosis GPA!

Heuristics: corrective strategies

Availability	Base rates: appropriate pretest probability? Does anything argue against my initial impression? How is this different from prior cases? What are the next 2 likely diagnosis? How do I exclude?
Anchoring	Reconsider in light of new data Always explain and reconcile inconsistencies
Framing	Examine case from alternate perspective Reframe: would it change inclination?
Blind obedience	Asses test accuracy or tactfully seek a second opinion
Premature closure	Return to case when refreshed: sleep on it if possible

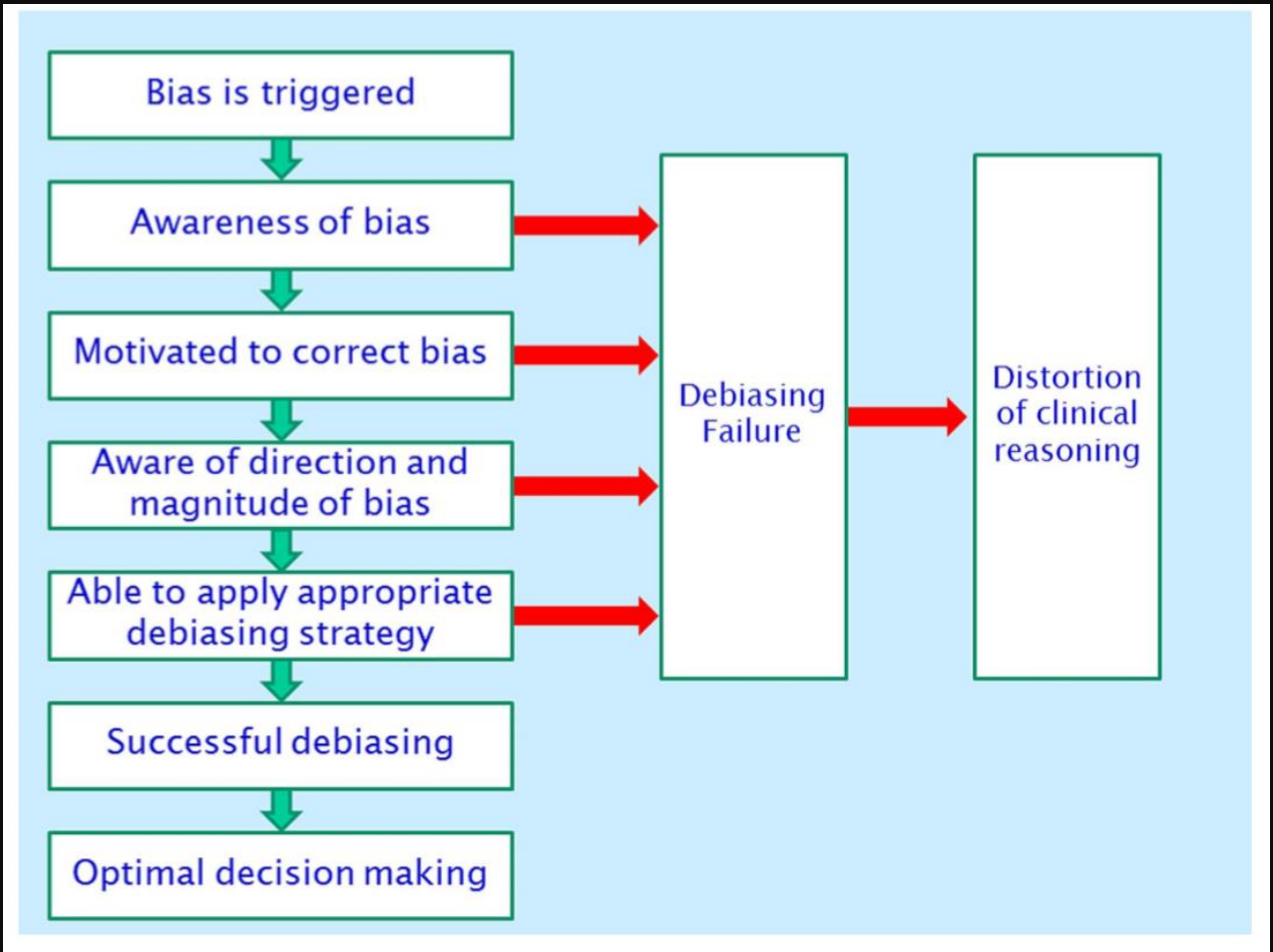
Cognitive Psychology of Missed Diagnosis. Ann Intern Med 2005

Biased judgment: corrective strategies

Representative bias	Be aware and seek true base rates
Overconfidence Bias	Be aware of limitations of your knowledge You are wrong more often than you think
Confirmation bias	Seek inconsistencies and strive to reconcile them even if it means re-visiting diagnosis
Illusory correlation bias	Question “correlations” objectively!
Hassle bias	Inconvenience is part of medicine “The best way out is always through”

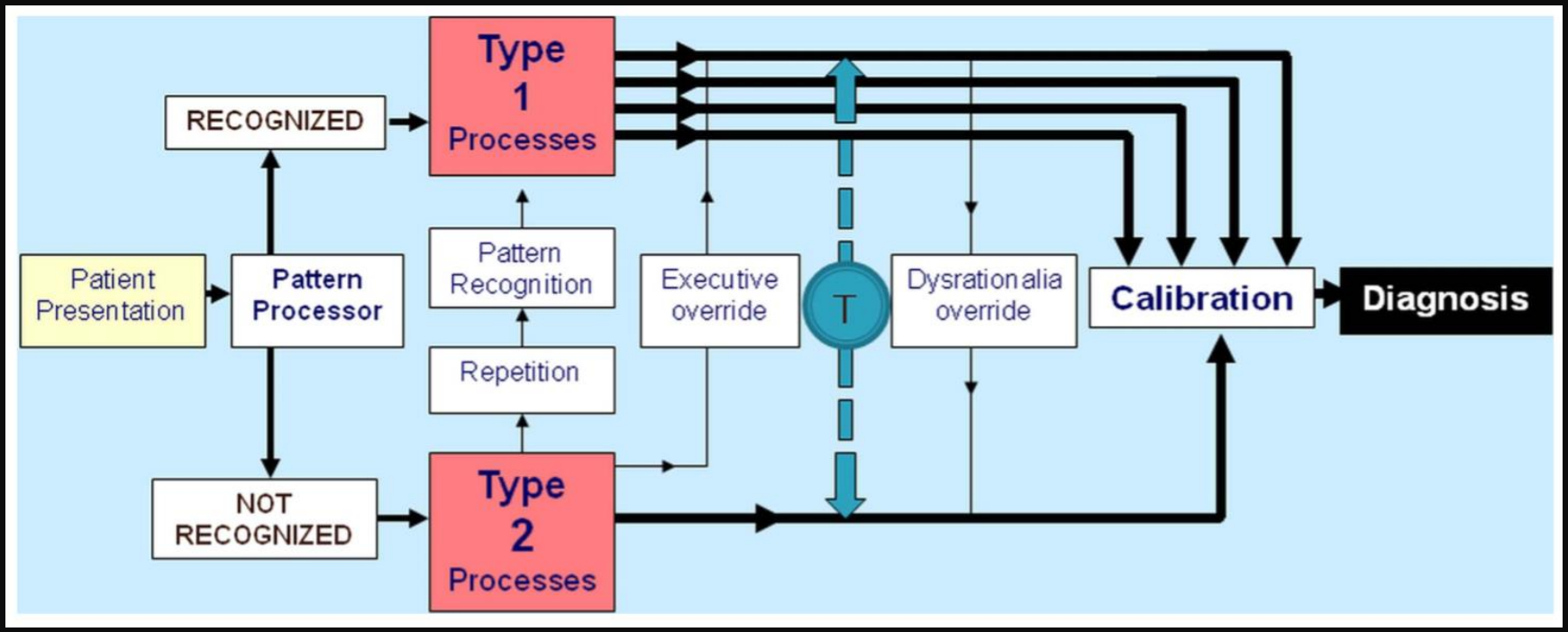
Jill Klien. BMJ Volume 330, 2005

Cognitive Debiasing



T Wilson, N Brekke. Psychol Bull. 1994

Clinical reasoning: debiasing



P Croskerry. Academic Medicine 2009

Teaching clinical reasoning

A game of numbers . . .

Clinical reasoning: testing and treatment thresholds

Clinical reasoning: testing and treatment thresholds

Pre test probability of disease

5%

<u>Tests/investigations:</u>
Sensitivity
Specificity
Positive predicative valves
Negative predicative values
Positive likelihood ratio
Negative likelihood ratio

90%

Post test probability of disease

Clinical reasoning: testing and treatment thresholds

Pre test probability of disease

5%

<u>Tests/investigations:</u>
Sensitivity
Specificity
Positive predicative valves
Negative predicative values
Positive likelihood ratio
Negative likelihood ratio

90%

Post test probability of disease

Clinical reasoning: applying tests:

Tests/investigations:

- Sensitivity
- Specificity

Values known for most tests

- Positive predicative valves
- Negative predicative values

Depends on prevalence of disease

- Positive likelihood ratio
- Negative likelihood ratio

Independent of prevalence of disease
Very useful to generate post test probability

Diagnostic utility of tests

Sensitivity and specificity generate likelihood ratios

LR	Δ In post test probability
10	↑ 45%
5	↑ 30%
2	↑ 15%
1	0
0.5	↓ 15%
0.2	↓ 30%
0.1	↓ 45%

$$LR+ = \frac{\text{Sensitivity}}{1 - \text{Specificity}}$$

$$LR- = \frac{1 - \text{Sensitivity}}{\text{Specificity}}$$

How do we then determine what our pre test probability is?

Clinical reasoning

History from patient
Physical examination
Known prevalence of disease
Prediction modules

} Help generate a pre test probability

Clinical reasoning

History from patient
Physical examination
Known prevalence of disease
Prediction modules

} Help generate a pre test probability

Diagnostic tests
- blood, urine and stool
- Xrays, CT scans, MRIs
- Ultrasounds and special imaging

} Help generate a post test probability

Let's practice. . .

Case: history

A 56 year old woman with a history of hypertension, presents to the ED with 2 weeks of shortness of breath (SOB). She gets SOB while walking, associated with chest tightness but no pain. She has noticed a cough productive of whitish sputum but has not had any fevers. Though, 3 weeks ago she had a “cold” after a long flight from China. No history of tobacco use. Her hubby has noticed that she wakes up SOB at night and sits up to open the windows. Her legs are also swollen but the right is more swollen than the left leg.

<u>Differential diagnosis:</u>

Heart failure

Pulmonary embolism

Pneumonia

Others: anemia, pleural effusions, overactive thyroid etc.

Case: physical exam and labs and CXR

BP 168/105, HR 115, Respiratory rate 22/min, 97% pulse oximetry

JVD+

Heart sounds normal

Lungs clear

Both legs swollen R = 38 cm L 37cm

Blood count is normal TFT and blood chemistry is normal and CXR shows a borderline enlarged heart but otherwise normal, no pneumonia seen.

Case:

Differential diagnosis:

Heart failure

Pulmonary embolism

Both?

Pneumonia

Others: anemia, cancer, pleural effusions, overactive thyroid etc.

Clinical reasoning

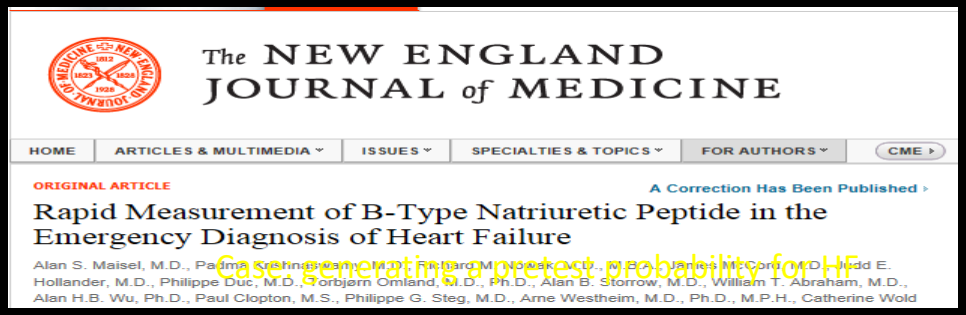
History from patient
Physical examination
Known prevalence of disease
Prediction modules

} Help generate a pre test probability

Diagnostic tests
- blood, urine and stool
- X-rays, CT scans, MRIs
- Ultrasounds and special imaging

} Help generate a post test probability

Case: generating a pretest probability for HF



Breathing Not Properly Study

- 1600 adults that presented to ED with SOB in 5 countries
- Ultimately 47% had heart failure as the diagnosis
- No finding of heart failure in 49%

Does she have a PE? Wells Score for PE

Clinical feature	Score
Previous PE or DVT	1.5 points
HR > 100	1.5 points
Surgery or immobilization within 4 wks	1.5 points
Hemoptysis	1 point
Active cancer	1 point
Clinical signs of DVT	3 points
Alternate diagnosis less likely than PE	3 points

Our patient had a score of 1.5

Wells et al. Thrombo Haemost 2000

Wells Score for PE pretest probability

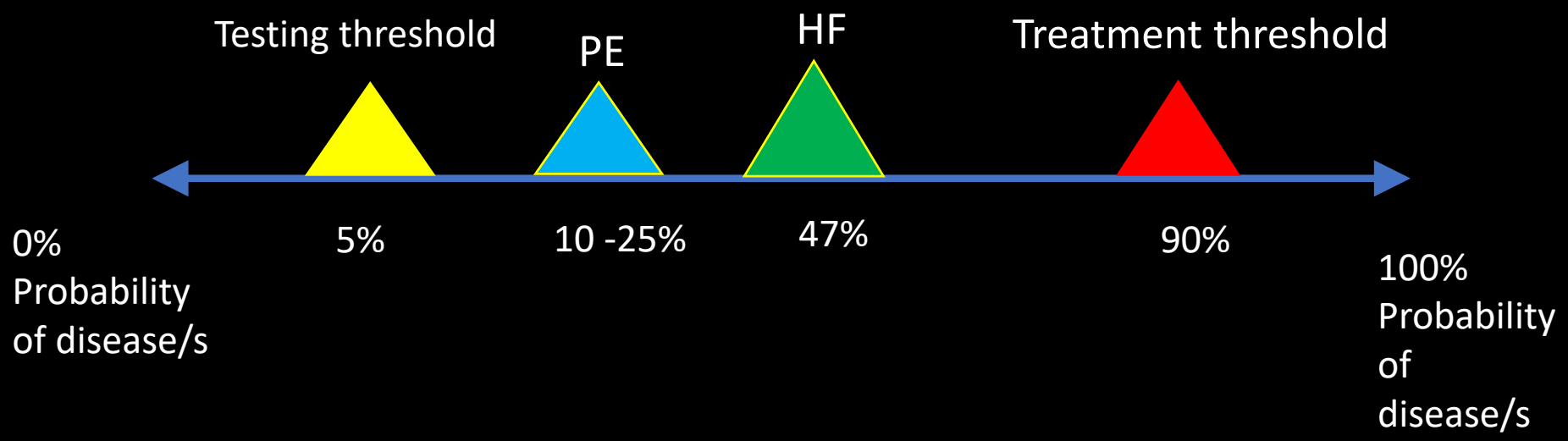
Pooled probability based on a systemic review of 29 studies and 31,200 patients

Score	Risk	Pretest probability of PE
0 - 1	low	6% (4 -8%)
2 - 6	Intermediate	23% (18- 28%)
≥ 7	high	49% (43 – 56%)

Two level Wells Score for PE		
0 - 4 points	PE unlikely	8.4% (6 – 11%)
≥ 5 points	PE likely	34.4% (29 – 40%)

Ceriani et al. J Thromb Haemo 2010

Clinical reasoning: testing and treatment thresholds



Diagnostic utility of tests

Sensitivity and Specificity generate Likelihood ratios

LR	Δ in post test probability
10	↑ 45%
5	↑ 30%
2	↑ 15%
1	0
0.5	↓ 15%
0.2	↓ 30%
0.1	↓ 45%

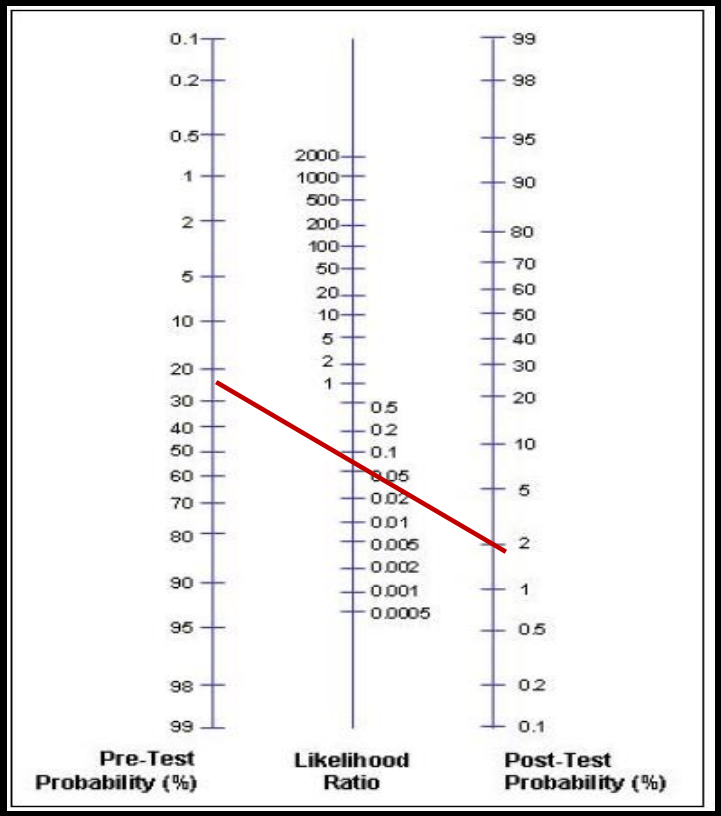
D-dimer for suspected PE (sensitivity 95% specificity 40%)

Pre-test prob = 20%

D dimer = negative
LR 0f 0.1

If negative Post-test probability = 2%

If positive = LR of 1.58
Post test probability = 35%



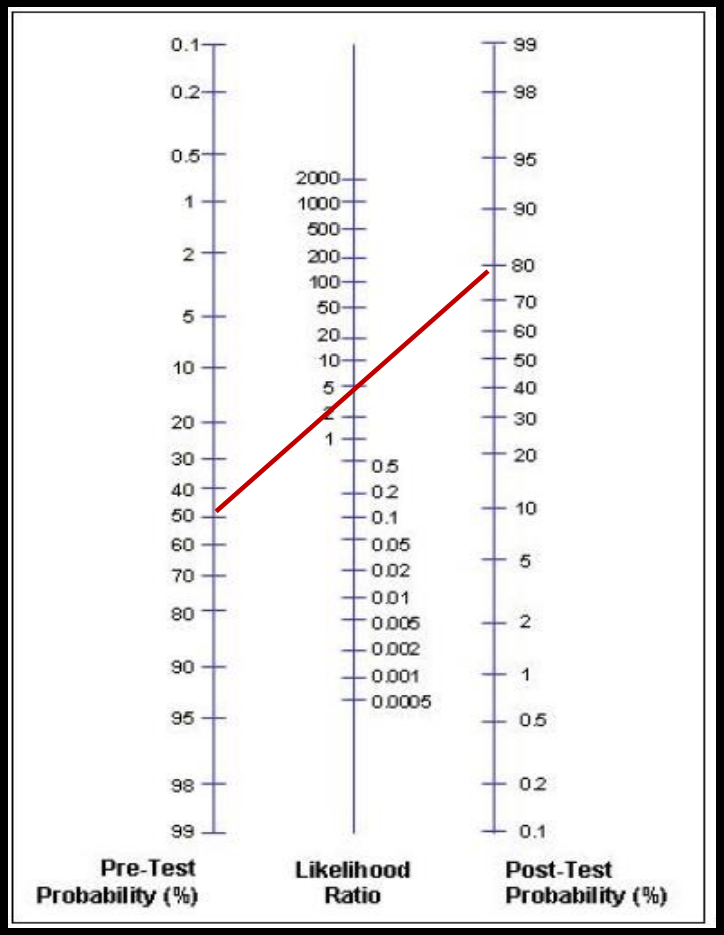
BNP for diagnosis of heart failure (sensitivity 90% spec 76%)

Pre-test probability = 50%

BNP > 100 = LR+ 0f 4

Post-test probability = 80%

BNP < 100 = LR- of 0.1
Post test probability of 9%



Case: Diagnosis

D-dimer was < 0.5 taking the post test probability of having a pulmonary embolus down to 2%

BNP was 550 taking the post test probability of heart failure to 80%

An echocardiogram showed reduced systolic function

Symptoms were caused by heart failure.

Teaching clinical reasoning

Grab a worksheet

The movie: Inception

The story. . .

- Chapter I; there will be blood…
- Chapter II; you give me fever…
- Chapter III; the liver leads…

Chapter I; there will be blood….admission #1

- 35 year old male with a history of ETOH use disorder
- Off alcohol for 8 months
- 2 weeks of fatigue, DOE and anorexia
- 121/70 98 18 100% 98F
- Icteric++, no LN, moderate splenomegaly

Chapter I; there will be blood.... admission #1

- Labs

- HB 4.9, MCV 143, WBC 3.6, PLT 108, retic 31
- Bilirubin 9.4/2.4, LDH 400, ALP 350, GGT 300
- Haptoglobulin <6, Coombs test +

- Team

- Autoimmune hemolytic anemia
- Pancytopenia: hypersplenism?
- Alcohol liver disease

Chapter I; there will be blood….admission #1

- Hematology

- Underlying liver disease with pancytopenia due to hyperslenism
- Now with an autoimmune hemolytic anemia
- LFTs consistent with hemolysis
- Rule out systemic connective tissue disease

- Plan

- Transfuse PRBC
- High dose prednisone
- Send for B12, folate, ANA et al

Chapter I; there will be blood.... admission #1

- Further labs

- ANA, ANCA negative, HIV and hepatitis screen negative
- B12 and folate normal
- Warm and cold antibodies detected

- Hospital course

- Prednisone 80mg/day
- PRBC x 4
- HB 8.1 on discharge

Chapter I; there will be blood….admission #2

- 1 week of DOE, fatigue and 102F fevers
- Splenomegaly and jaundice
- HB 5, WBC 0.9, PLT 100, retic 23

- Hematology

- Idiopathic AIHA flare; start solumedrol
- Bone marrow biopsy
- Thrombocytopenia due to hypersplenism

Chapter I; there will be blood….admission #2

- Bone marrow
  - Hyper cellular marrow
  - No atypical infiltrates, normal flow cytometry
  - All consistent with peripheral destruction and sequestration

- Hospital course
  - PRBC x 6 (warmed up)
  - Solumedrol x 4 days, discharged on prednisone of 60mg

Chapter I; there will be blood....admission #3

- HB 4.6, WBC 4.5, PLT 40
- Fevers 101F

- AIHA flare
- Hepatosplenomegaly on ultrasound

- PRBC x 7
- Rituximab and iv dexamethasone
- Prednisone 80mg

Chapter I; there will be blood….admission #4

- HB 5.9, WBC 0.8, PLT 50
- Body aches, fevers 101F
- PRBC x 5
- Cyclosporine 100mg bid and prednisone 60mg

Chapter I; there will be blood....admission #5

- Aches, pains and fevers 103F
- HB 5.7, WBC 7.2, PLT 85
- CT #1: HSM, splenic infarcts and aortic LNs
- PRBC x 2
- Cyclosporine stopped but steroids continued

Chapter I; there will be blood….admission #6

- RUQ pain, aches and fevers 101 – 103F
- HB 6.5, WBC 2.0, PLT 39
- CT #2: new hypo dense liver lesions, aortic LNs
- PRBC x 5, PLTS x 30 units, IVIG, prednisone
- Surgery consulted for splenectomy: “wait till infection clears”

Chapter I; there will be blood....admission #7

- Aches and pains, fevers 100 – 102F
- HB 6.3, WBC 2.2, PLTS 62
- CT #3: HSM, slight reduction in liver lesions, stable aortic LN
- PRBC x 3, prednisone 60mg
- Surgery: planning elective splenectomy

Chapter I; there will be blood….admission #8

- RUQ pain, aches and fevers 101 – 103F
- HB 5.8, WBC 1.9, PLT 105
- PRBC x 3, IVIG, prednisone 60mg

Chapter I; there will be blood....admission #9

- Aches and pains, no fevers
- HB 5.5, WBC 5.9 PLT 102
- PRBC x 3, IVIG, prednisone 60mg

Chapter I; there will be blood….admission #10

- RUQ pains, fevers 101 – 103F
- HB 6.2, WBC 9, PLT 145
- CT #4: splenic infarcts, reduced liver lesions, aortic LN
- PRBC x 6, prednisone 100mg
- **Splenectomy DONE!** which shows normal pathology

Chapter I; there will be blood….admission #11

- Fevers 102 – 103F
- HB 6. . . **yes hemolysis! after splenectomy**
- CT #6: larger left hepatic lobe lesion
- PRBC x 9, prednisone 60mg
- IR guided biopsy is planned

Chapter I; there will be blood….

- To be continued. . .

Chapter II; you give me fever…

Life does fade as the fever rages. . .

Chapter II; you give me fever…admission # 2

- 39yr old male with AIHA and ETOH liver disease
- RUQ pains, fevers 101 – 102F
- All cultures negative, CXR normal, USS without cholecystitis
- No antibiotics given

Chapter II; you give me fever…admission # 3

- RUQ pain, fevers 101 – 102F
- All cultures negative, CXR normal
- Ceftriaxone and metronidazole for 5 days
- No antibiotics on discharge

Chapter II; you give me fever…admission # 4

- AIHA + leucopenia
- Aches, pains and fevers 101 – 103F.
- Urine culture: E Faecalis but no urinary symptoms
- CT #1 : HSM, splenic infarcts, no pyelonephritis
- ID consult: E faecalis UTI; ampicillin x 7 days

Chapter II; you give me fever…admission # 6

- AIHA, WBC 2 (ANC 540: lowest ever)
- Aches and pains, fevers 102F
- All cultures and CXR negative
- Started on imipenem by primary team
- CT #2 shows **new liver hypo densities** and splenic infarcts?

Chapter II; you give me fever…admission # 6

- ID consult service

- Hepatosplenic candidiasis vs histoplasmosis vs blastomycosis (less likely)
- Concern for brucellosis, Q fever and leptospirosis
- Blood and urine cultures, urine histo antigen
- Serum crypto antigen, brucella and leptospira serology
- IR biopsy of hepatic lesions
- Continue imipenem and start fluconazole

- ID consult service (2 days later)

- Still febrile
- Add vancomycin, switch to itraconazole

Chapter II; you give me fever…admission # 6

- Now afebrile for over 72hrs

- ID consult service

- Splenic + hepatic lesions with fevers, now improved
- Negative cultures; improvement likely from antifungals or steroids
- Risk for disseminated candidiasis is low given absence of severe prolonged neutropenia
- Endemic mycosis like histoplasmosis more likely
- Tissue needed; IR guided biopsy
- Stop imipenem, vanco and itraconazole, start voriconazole

Chapter II; you give me fever…admission # 6

- Patient remains afebrile
- Combined IR and Hem conference; “biopsy after repeat CT”
- At this time platelets 50

- CT #3: read by IR as showing slight interval resolution of lesions, likely fungal micro abscesses

- IR decide to hold on biopsy

- Patient discharged on voriconazole

Chapter II; you give me fever…admission # 7

- AIHA, WBC 2.4
- Fevers 101 – 102F
- CT #4: **decrease in size of liver lesions**, stable aortic LNs

- ID consult

- Urine histo and brucella serology negative
- Lesions have decreased in size on CT
- **Hepatosplenic azole responsive lesions; consistent with hepatosplenic candidiasis**
- Continue voriconazole

Chapter II; you give me fever…admission # 8 & 9

- AIHA
- RUQ pain, fevers 101 – 103F
- All cultures negative
- No ID consult
- Voriconazole continued

Chapter II; you give me fever…admission # 10

- Post op (splenectomy) fevers 101 – 102F

- ID consult

 - Probable hepatosplenic candidiasis
 - Off voriconazole for 2weeks?
 - Change voriconazole to fluconazole
 - Post op fevers with negative cultures
 - Hold antibiotics

Chapter II; you give me fever…admission # 11

- Still febrile
- Now on fluconazole
- All cultures negative

- CT #7: confluent large lesion in left hepatic lobe

- <u>ID consult</u>
- All cultures negative
- Uncontrolled fungal infection?
- Start amphotericin to serve as induction therapy
- Liver biopsy

Chapter II; you give me fever…admission # 11

- Still high grade fevers 101 – 103F
- **IR liver biopsy done**
- ID

 - Ampho changed to fluconazole

Chapter II; you give me fever…admission # 12

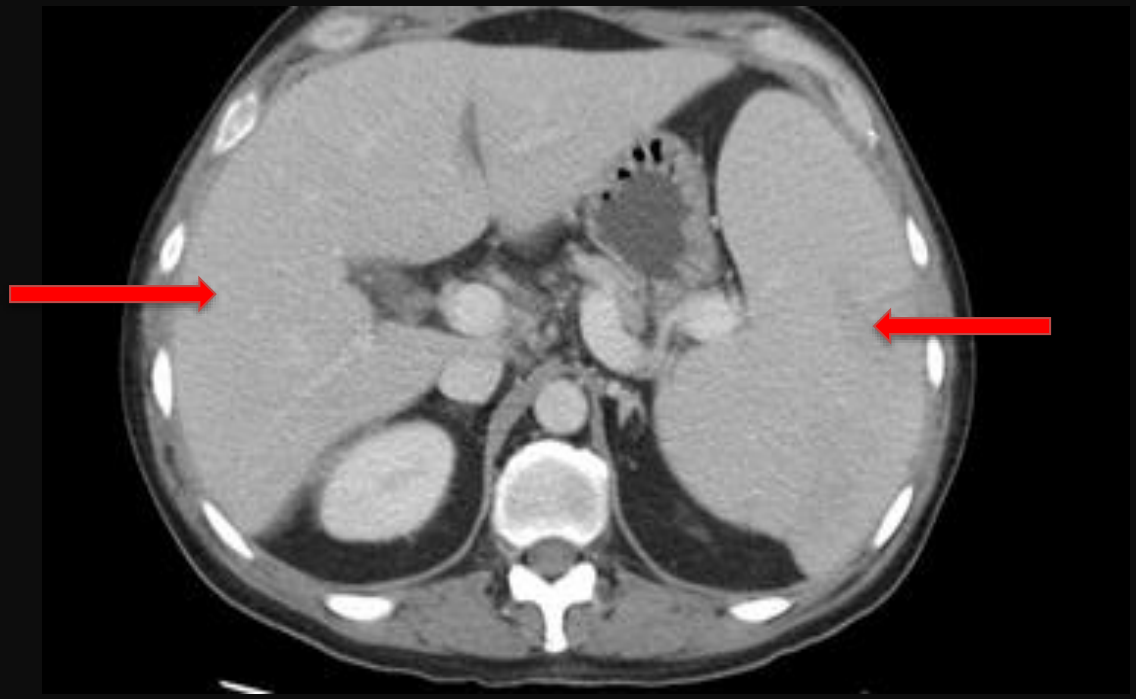
- Aches, abdominal pains
- Fevers 101 – 103F
- To be continued. . . .

Chapter III; the liver leads…

Is life worth living? It all depends on the liver

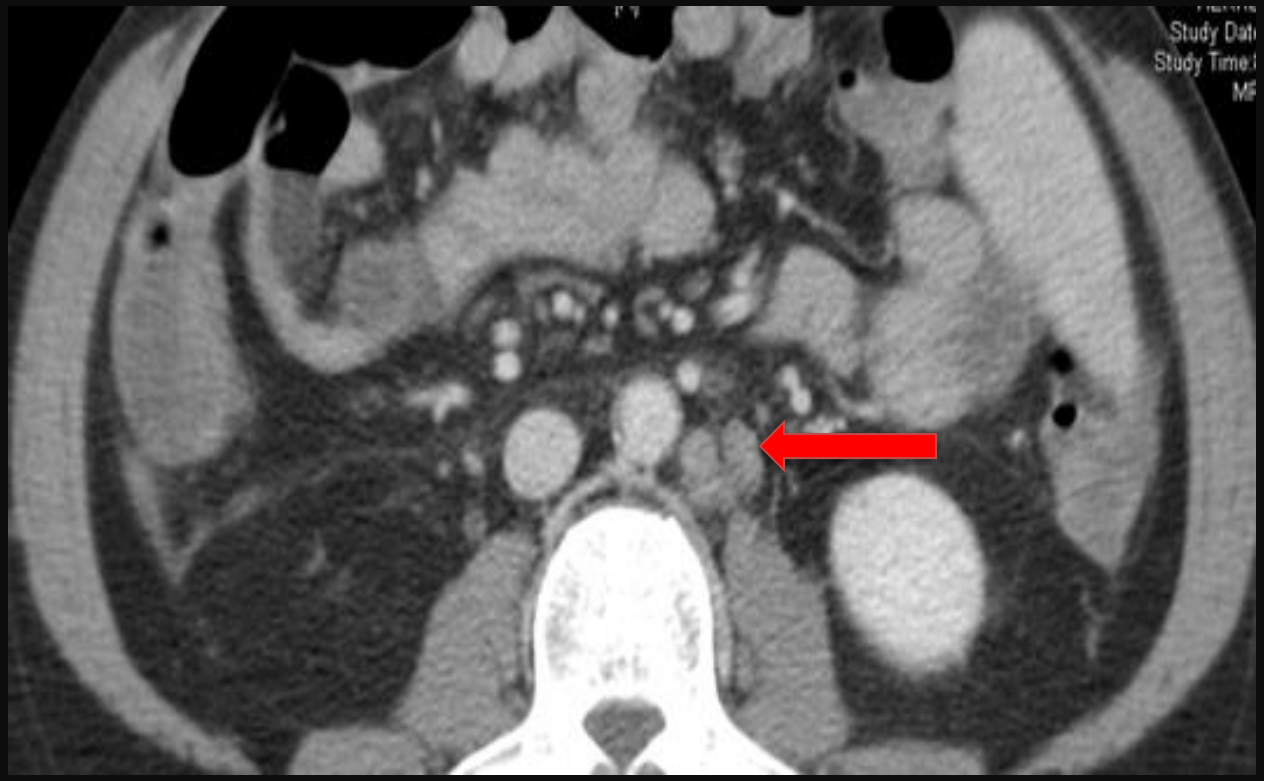
Williams James

Chapter III; the liver leads…CT #1



CT shows marked splenomegaly

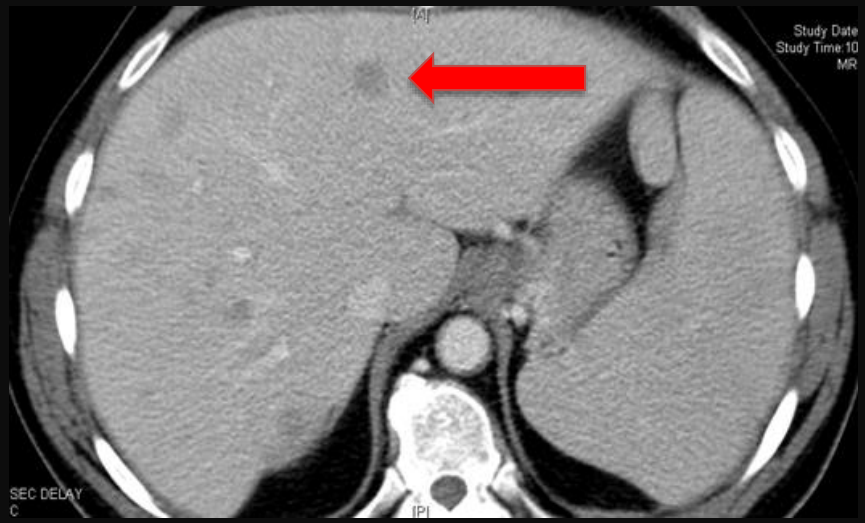
Chapter III; the liver leads…CT #1



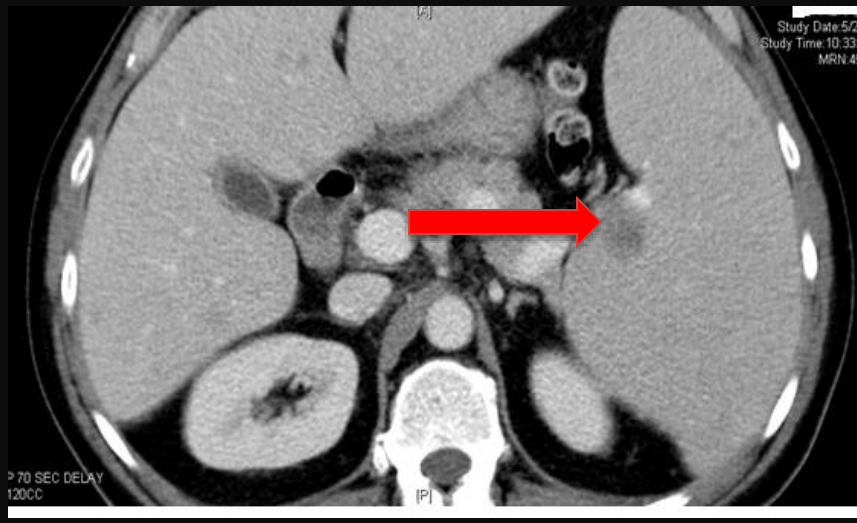
CT shows left para – aortic lymphadenopathy

Chapter III; the liver leads…CT #2

Multiple liver hypodensities

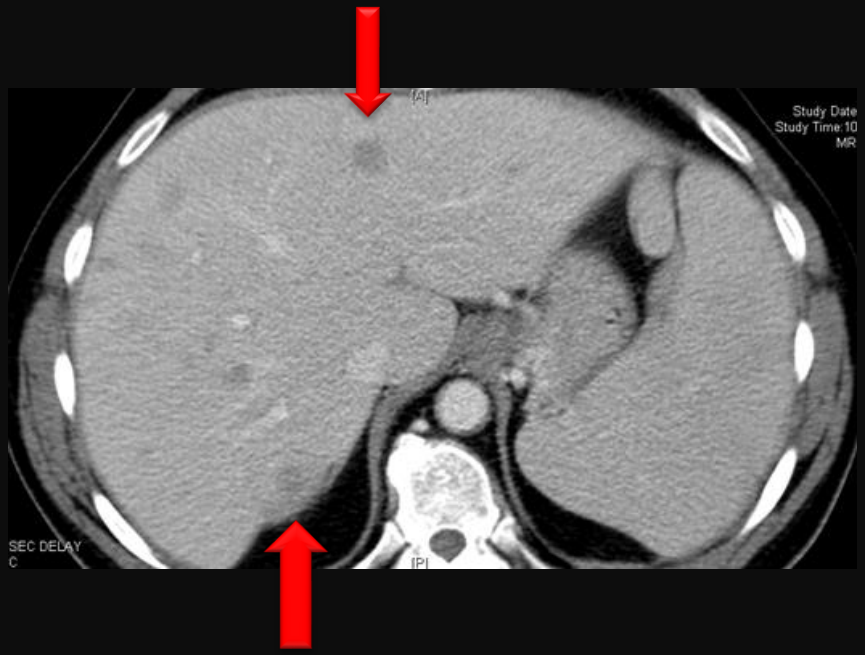


Splenic infarcts

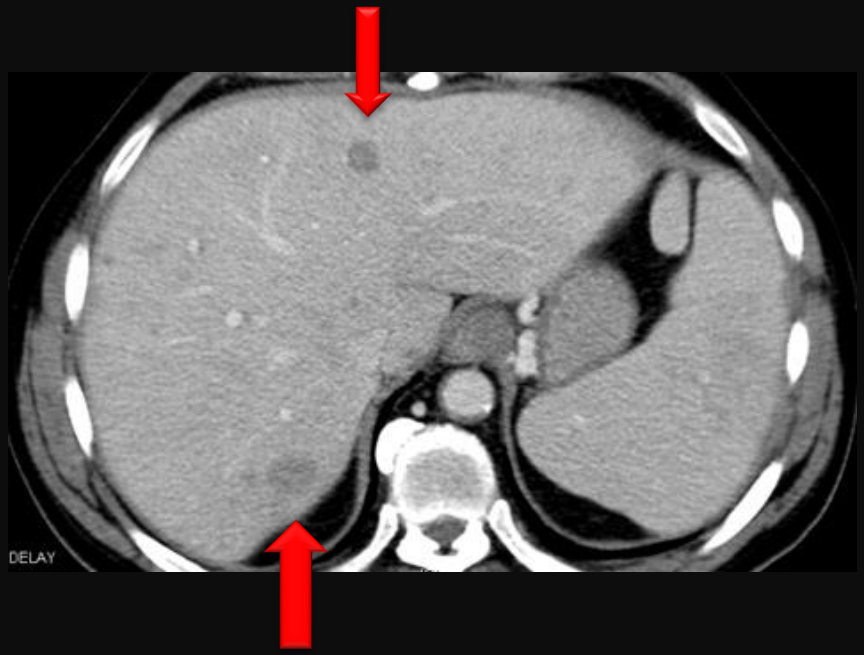


Chapter III; the liver leads…CT # 2 and 3

CT #2

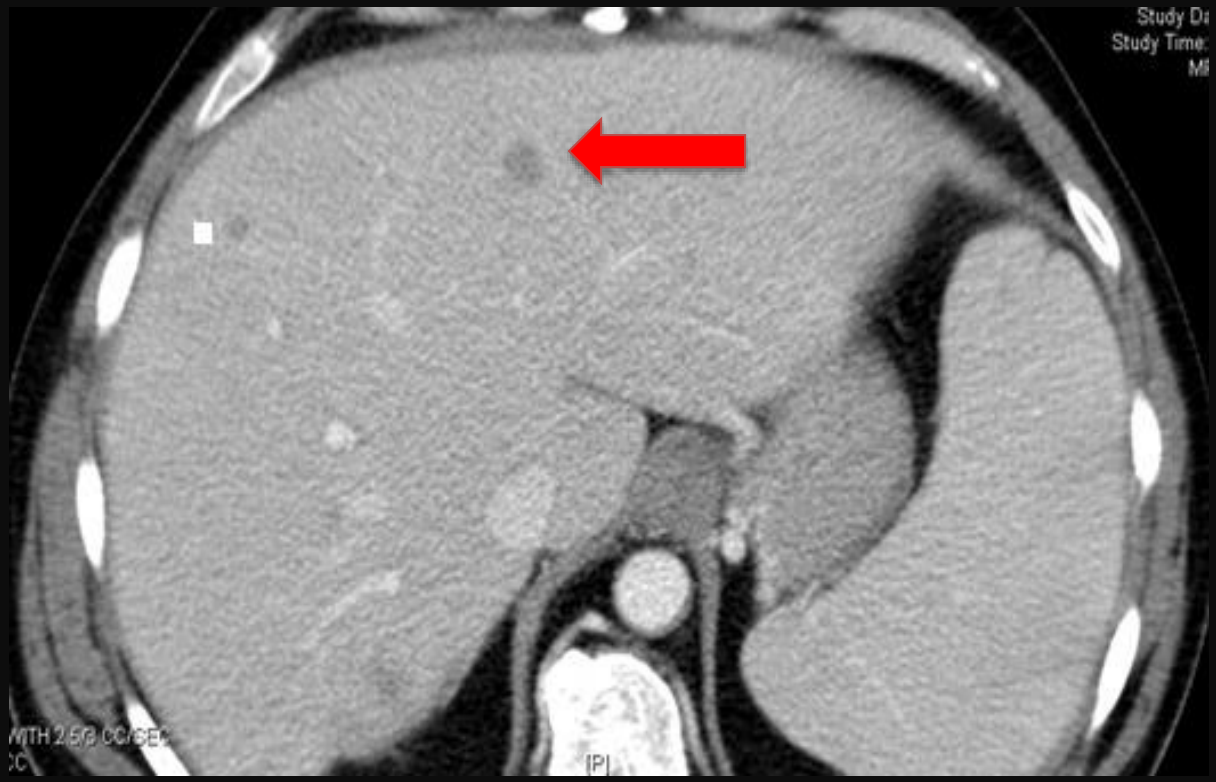


CT #3 **“improved”** per IR



Platelet count was 50

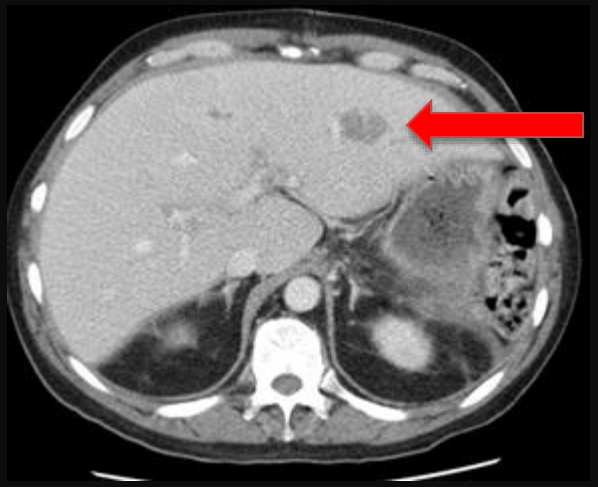
Chapter III; the liver leads…CT #4



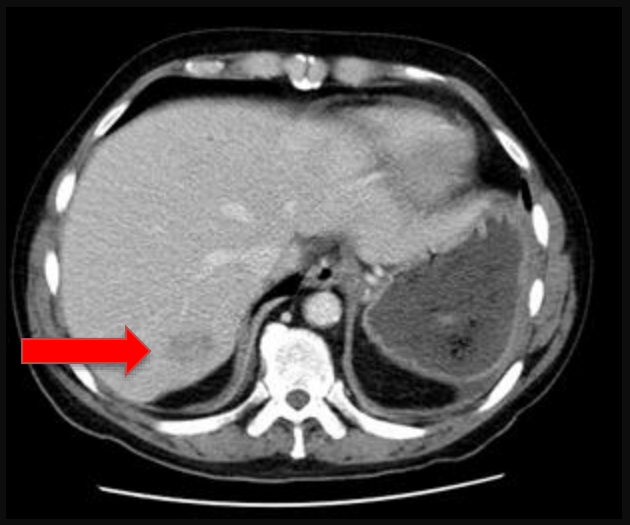
CT shows a reduction in the liver lesions

Chapter III; the liver leads…CT #6

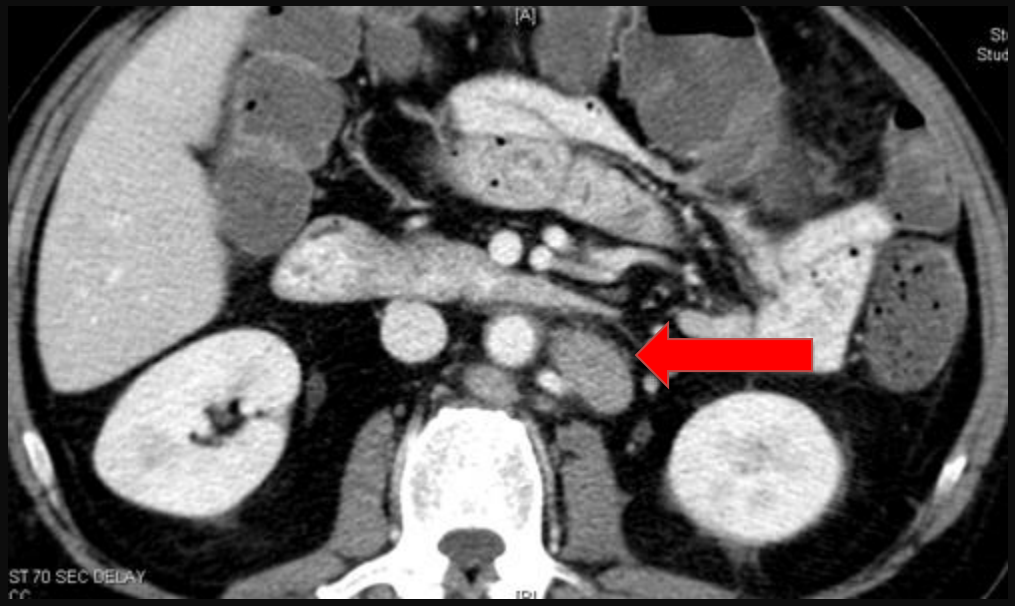
Worsening liver lesions



Worsening liver lesions

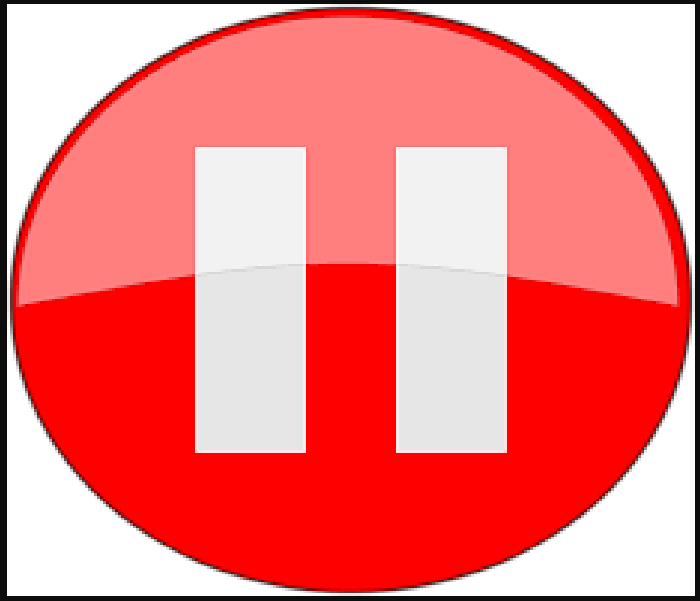


Chapter III; the liver leads…CT #6



Worsening of para – aortic lymphadenopathy

To be continued . . .



Back to our story. . .

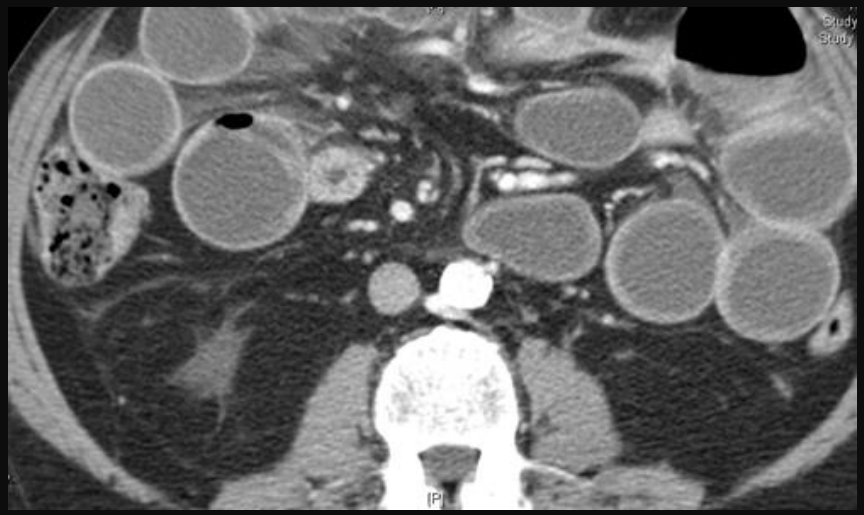
Chapter III; the liver leads…

- Ultimately a CT guided liver biopsy was done 4 months after the liver lesions were identified
- Hodgkin's Lymphoma (lymphocyte depleted)
- No evidence of hepatic candidiasis, fungal, bacterial infection or ETOH liver disease
- Final diagnosis

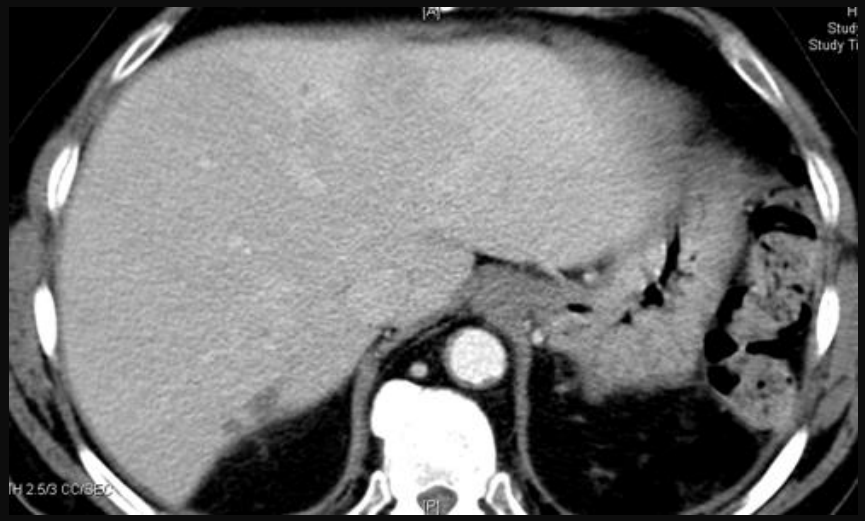
Stage IV Hodgkin's Lymphoma presenting with cold and warm antibody auto immune hemolytic anemia that led to splenomegaly resulting in thrombocytopenia and leucopenia

Post (first) chemotherapy

Resolution of left para – aortic LNs

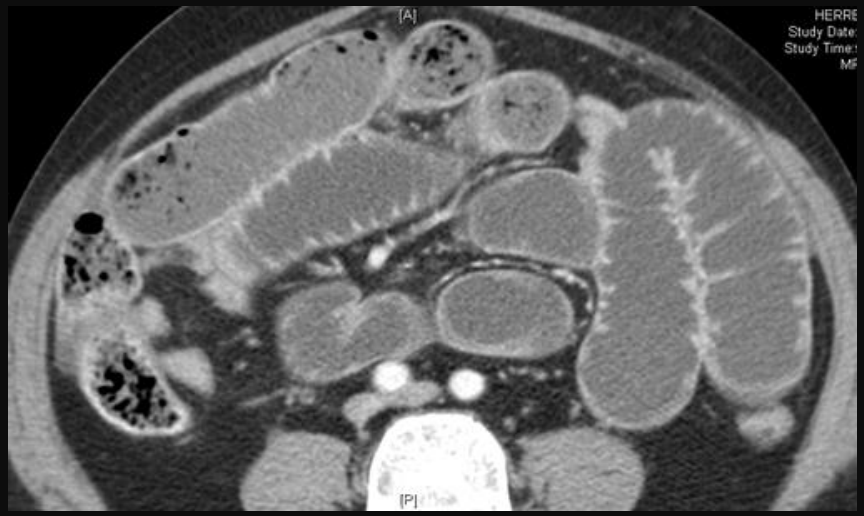


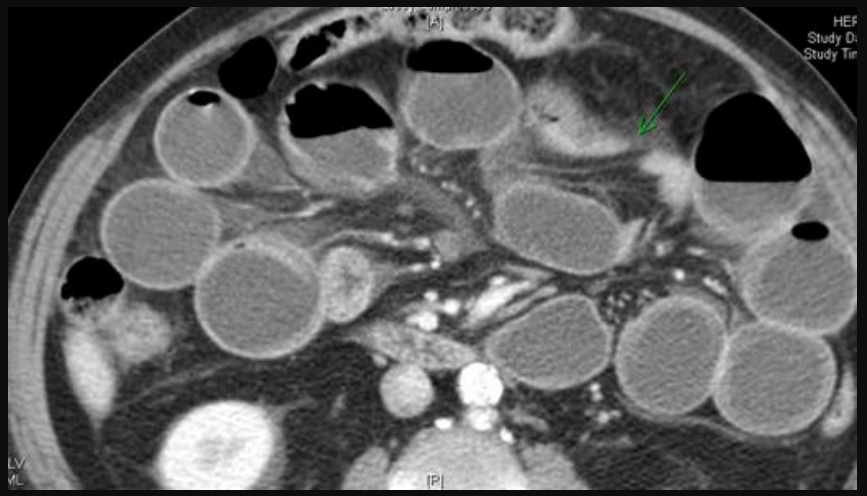
Marked reduction in liver lesions



No more evidence of a hemolytic anemia

Small bowel obstruction due to surgical adhesions





Delayed diagnosis

- Consequences
  - approx 60 units of PRBC
  - approx 60 units of platelets
  - $$$$$ of IVIG
  - Courses of iv solumedrol
  - 494 days of prednisone = 296 grams
  - courses of rituximab, cyclosporine and cyclophosphamide
  - 127 days of antifungal treatment (azoles + ampho)
  - splenectomy
  - small bowel obstruction due to post surgical adhesions
  - MRSA bacteremia with endocarditis

Delayed or missed diagnosis

- Occur due to pitfalls in clinical reasoning
- We make mistakes when we encounter complex problems.
- Everyday situations are sufficiently complex to elicit mistakes

Back to our patient

- We focused more on his hemolysis than on the cause of it ; perhaps we missed the forest for the trees

- We encountered recognized and predictable pitfalls in clinical reasoning:
  - Availability bias
  - Illusory correlation
  - Premature closure
  - Anchoring+++++
  - Diagnostic momentum
  - Overconfidence on experts
  - Hassle bias

Immune hemolysis

- AHA is rare, prevalence of 17/100,000
- 85% are due to warm antibodies, 15% cold
- Overall 50% are idiopathic and 50% are secondary

Warm	**Cold**
lymphomas 10 – 40%	lymphomas 10 - 35%
SLE 30 – 40%	cold disease agglutinin dx 30%
CLL 7%	Waldenstrom's disease 15%
Drugs, infections, PCH, CVID	CLL, infections, drugs,

Our patient

- Presented with severe hemolytic anemia
- ANA, HIV, SPEP etc were all negative

- **Framing:** pt with warm and cold immune hemolytic anemia with negative serology tests (as above)
- **Anchored**: idiopathic AIHA

- **Challenges (inconsistencies) to anchor and responses:**

Persistent high fevers: cultures negative therefore due to his AIHA

Abnormal LFTS: always considered consistent with hemolysis

Some facts on hemolysis

- **LFTs in hemolysis:**

Increased	**No change/reduced***
Bilirubin	Alkaline Phosphatase*
LDH	GGT*
AST	ALT

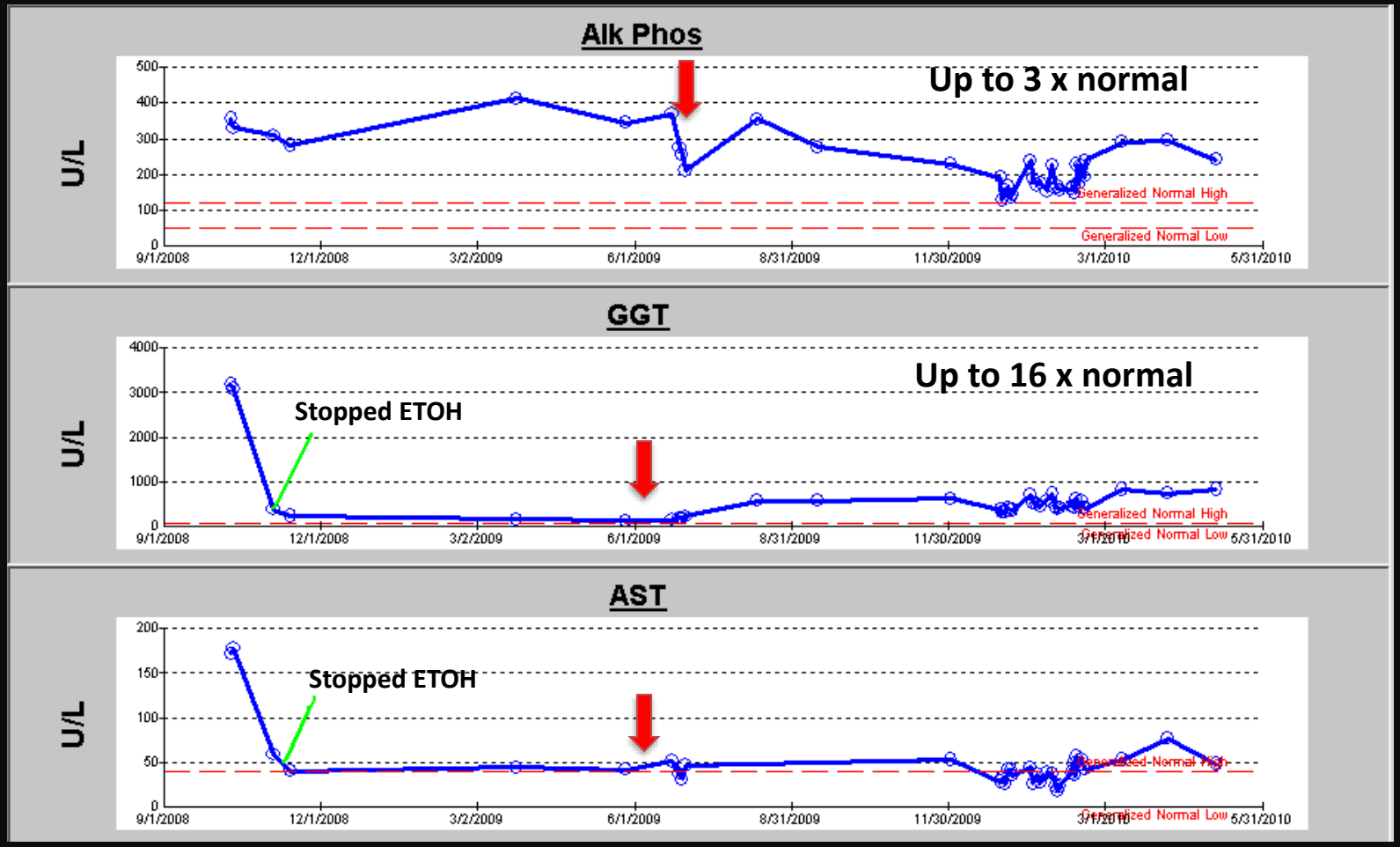
- Total serum bilirubin is never > 4 – 5mg/dl

Harrison's Principles of Medicine

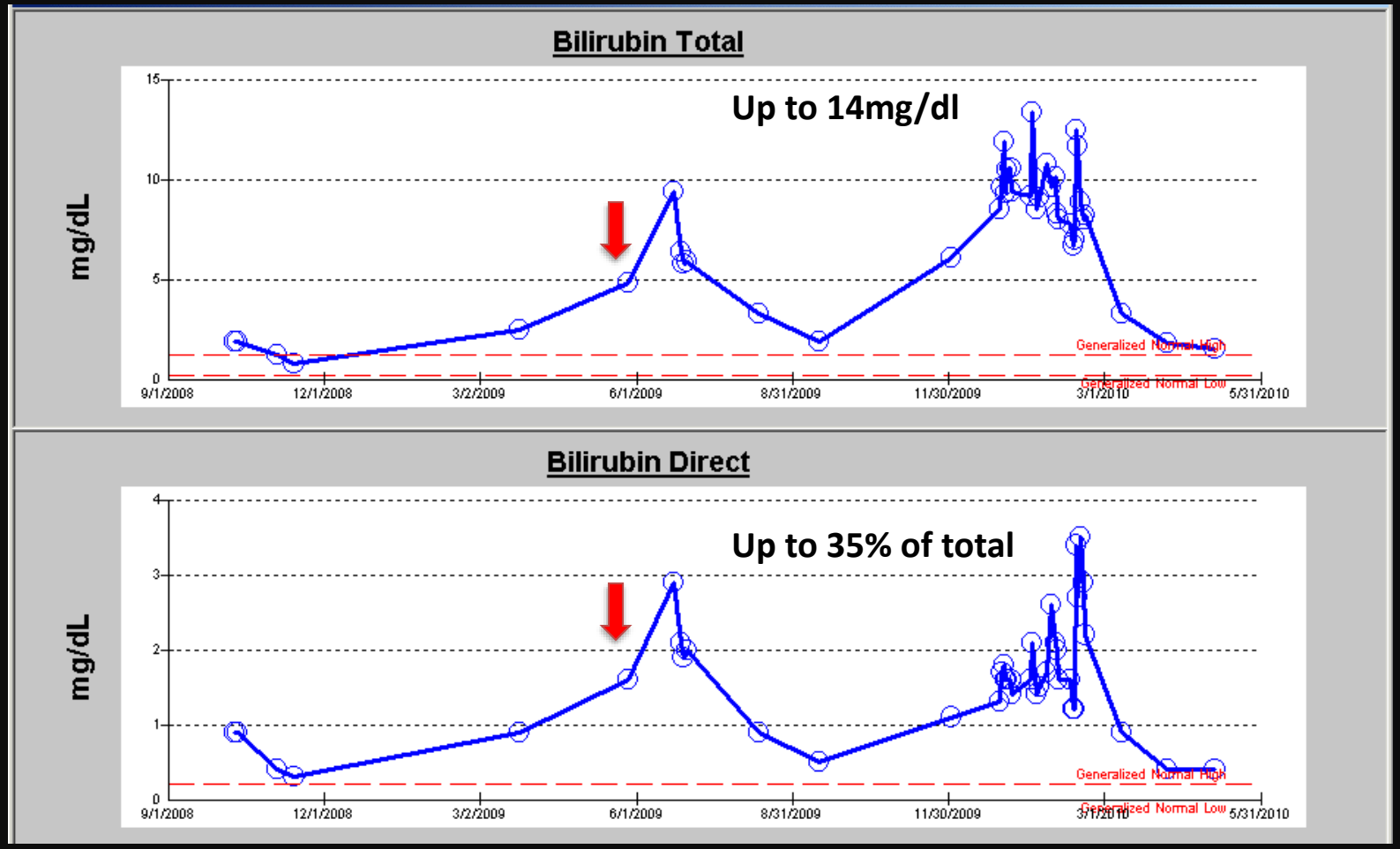
- Total bilirubin rarely ever > 5mg/dl and direct usually < 15% of total
- Fevers more likely in secondary AIHA

C Packman, Blood Reviews Vol 22 June 2008

Our patient: labs for 11 months before abnormal CT



Our Patient


Bilirubin Total
mg/dL
Up to 14mg/dl
15
10
5
0
9/1/2008
12/1/2008
3/2/2009
6/1/2009
8/31/2009
11/30/2009
3/1/2010
5/31/2010
Generalized Normal High
Generalized Normal Low
Bilirubin Direct
mg/dL
Up to 35% of total
4
3
2
1
0
9/1/2008
12/1/2008
3/2/2009
6/1/2009
8/31/2009
11/30/2009
5/31/2010
Generalized Normal High
Generalized Normal Low

Our patient

- **Alternate framing:**

39 year old male with warm and cold AIHA who presents with fevers, hepatosplenomegaly, para – aortic lymphadenopathy and LFTs suggestive of an infiltrative disease pattern without biliary dilatation.

- Would have raised the question of a liver biopsy **(months before the CT was even abnormal)** to evaluate for a secondary cause of AIHA such as a lymphoma

Our Patient

- RUQ pain and fevers with negative cultures
- CT showed multiple liver hypo densities

- **Framing #1**

  Given immunosuppressive Rx , leucopenia , CT findings are concerning for hepato splenic candidiasis vs histoplasmosis vs blastomycosis

- Became afebrile transiently after antibiotics and antifungals

- **Framing #2**

  …now seemingly improved; given negative cultures, improvement seems most likely from antifungal or prednisone therapy.

- IR liver biopsy recommended

Our patient

- **Blind obedience to authority/technology**

  His CT "improved" per IR **(hassle bias)** within 9 days of treatment, so discharged

- **Framing #3 and final anchoring**

  Urine histo negative. Hepatosplenic azole responsive lesions; consistent with hepatosplenic candidiasis.

- **Diagnosis momentum**; each time he came in febrile he got more or different anti fungals, in addition, he got antibiotics

Clinical reasoning

- Diagnostic reasoning is limited by our ability to assign the appropriate pretest probability to clinical presentations
- Our appropriate pretest generating ability can be restricted by our clinical experience
- The gap can be narrowed by actively questioning our assumptions to ensure we achieve consistency

Hepatosplenic candidiasis

- First reported in 1969
- Occurs almost exclusively in patients with acute leukemia who develop severe neutropenia post chemo
- Very few prolonged neutropenic patients with lymphoma and sarcomas
- Only 6 reported cases in non neutropenic patients; usually single large abscesses or complicating abdominal surgery
- Radiologic improvement takes a minimum of 4 weeks to months which lags behind clinical response

Thaler et al, Annals 1988 Vol 108
Kontoyiannis et al, Infect Dis North America 2000
Shirkhoda et al, Radiology 1986 Vol 159

Our patient

- **Challenges (inconsistencies) to anchor**

- He had RUQ pain and fevers for 5 months before the abnormal CT
- Lowest ANC 540 for 1 day ONLY
- He had no established leukemia or lymphoma
- He improved radiologically within 10 days of treatment
- He never improved clinically; fevers and RUQ pain persisted for months

Not consistent with hepatosplenic candidiasis

Trivia; old wine in a new bottle

- *Pel- Ebstein* fever: fevers that cyclically increase then decrease over an average period of one or to weeks in patients with Hodgkin's lymphoma

- Pel PK. Zur first reported cases in 1885 and Ebstein W. Das described cases in 1887

- In 1959 Richard Alan John Asher declared it mythical in his Lancet *making sense* series

- You decide; myth or reality?

Teaching clinical reasoning

Steps involved

1 Understand the process of clinical reasoning √

2 Recognize your own process of clinical reasoning in real time √

3 Be cognizant of pitfalls in clinical reasoning √

4 Apply real time strategies to avoid pitfalls in clinical reasoning √

5 Personalize your approach

6 Make your thinking visible to your learners in real time

Personal approach

My real time cognitive approach to cases with learners:

Acronym: A DIVA PR^2OF

A = Assign appropriate pretest probability

D = Determine most effect discriminating factor to narrow field

I = Internal consistency

V = Validate assumptions

A = Anticipate response to both possible test results: + vs –

P = Probe to disprove your hypothesis

R = Reframe your framing

R = Reconcile inconsistencies

O = Often wrong

F = Figure out why we were wrong

Acronym: A DIVA PR^{2}OF

A = Appropriate pretest probability

- Counters availability and representative biases

D = Determine most effect discriminating factor to narrow field

- Narrows differentials and enables focused testing

I = Internal consistency

- Counters anchoring, premature closure, confirmatory bias and diagnosis momentum

V = Validate! assumptions

- Counters anchoring, premature closure, confirmatory bias and diagnosis momentum

A = Anticipate response to both possible test results: + vs –

- Counters confirmatory bias, anchoring and premature closure

Acronym: A DIVA PR^{2}OF

P = Probe to disprove your hypothesis

- Counters over confidence , anchoring and premature closure

R = Reframe your framing

- Counters premature closure

R = Reconcile inconsistencies

- Counters anchoring, confirmatory bias, illusory correlation and hassle bias and premature closure

O = Often wrong

- Counters over confidence and inspires life long learning

F = Figure out why we were wrong

- Counters over confidence and inspires life long learning

Acronym: A DIVA PR^2OF

39 year old male with warm and cold AIHA who presents with fevers, hepatosplenomegaly and para – aortic lymphadenopathy

⬇

Assign appropriate pretest probability

- Secondary causes of AIHA are just as common as idiopathic AIHA
- Of all secondary causes: lymphoma is the commonest

⬇

Determine most effective discriminating factor to narrow the field

- His LFT pattern suggested an infiltrative pattern and not hemolysis or alcohol liver disease

⬇

AIHA + infiltrative LFT pattern = liver biopsy

ADVAIR

A: Appropriate pretest probability

D: Discriminating factor

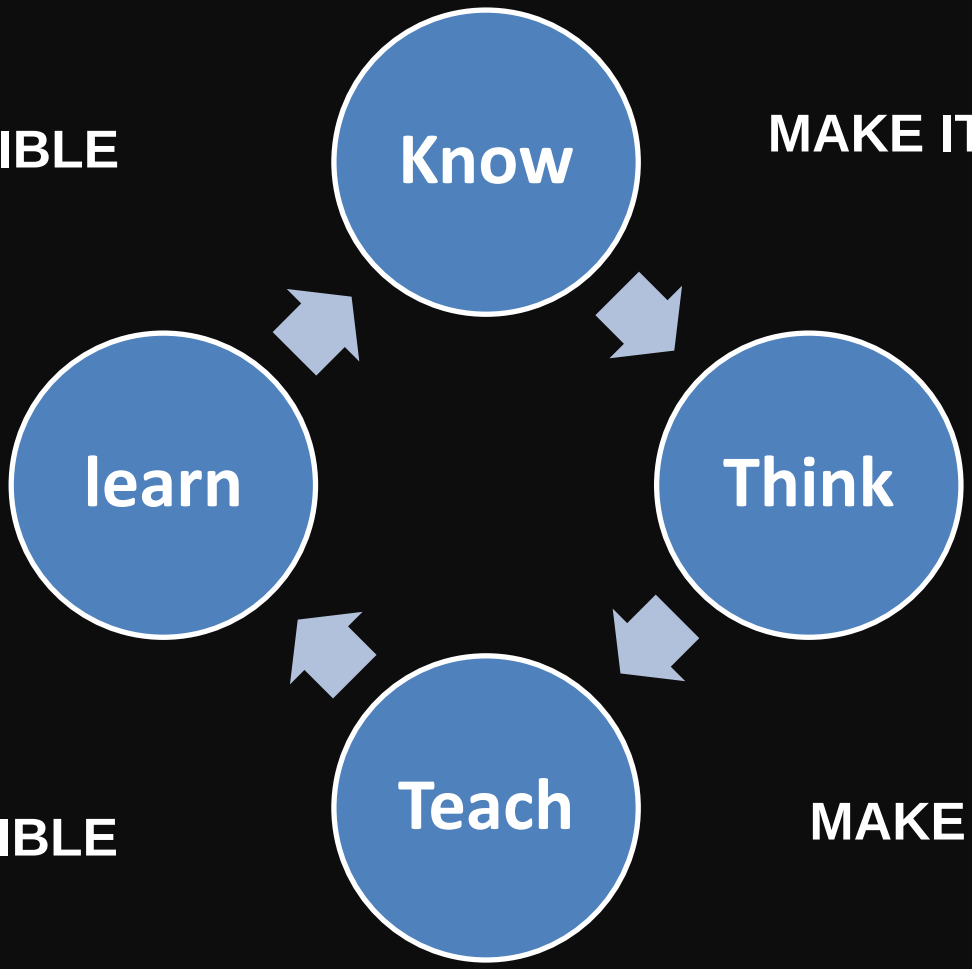
V: Validate assumptions

A: Anticipate both possible test results

I: Internal consistency always

R: Reconcile internal inconsistencies

Clinical Reasoning: the KTTL cycle



Clinical reasoning

Of one thing be certain; always think about how you think while you think, albeit within the limitations of your thinking mind.

Of questions and answers, strive to answer questions always but pause to question answers often.

We should always assume that our presumption about our assumptions is just that; an assumption that needs to be validated and clothed in certainty.

Strive for consistency always; to ignore facts does not change the facts.

Thank you

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