Partnership of the Minds

How your brain can referee the Murphy vs. Ockham title fight

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Disclosure

- None
Overview

- Walk through an improbable case
- Introduce causes of common medical errors
- Highlight its importance for IPAC
- Outline mitigation strategies
Prologue - Cautionary Notes

- Retrospectoscope works well to spot errors
- Thoughts/intent inferred from written record
  - Incomplete
  - Highlight teaching points
- My last names are not Skinner or Freud
- I am guilty as charged
Case Presentation

- Patient
  - HTN/PCKD → CRF (Cr 250)
  - Orchiectomy (2 yr. prior)
    - “Florid granulomatous disease”
    - Necrotizing/abscess formation
    - Negative stains/no culture performed
  - Ex smoker
  - From the Middle East (left >10 yr.)
  - No known history/contact with TB
  - Unknown TST status/HIV neg.
  - Worked in healthcare
Case Presentation

- Respirology consult (Jan)
  - 4 weeks of dyspnea/dry cough/weight loss
  - Underwhelming “Infectious” symptoms
  - R sided pleural effusion (moderate)
    - Volume overload vs. other (malignancy)
  - Pleural fluid
    - Bloody
    - Slight elevated WBC (0.7 with 64% lymphocytic)
    - Borderline exudative
    - Cytology & cultures x 2 neg.
Case Presentation

- Follow up (1 week later)
  - “Better” but dry cough
  - CXR improved R effusion
  - Volume overload vs. malignancy
    - Echo (nil)
    - CT chest/abdomen ordered
    - Thoracentesis as needed
    - Given diuretics
      - Effusion further improved 2 wks. later
Case Presentation

- CT chest (March)
  - Bilateral large effusions
  - Faint tree in bud pattern (upper lobes)
  - Collapse/consolidation of multiple lobes
  - Stranding/congestion small bowel mesentery
- No immediate clinical follow up
Case Presentation

- ER (3 weeks post CT)
  - Enlarged/painful irregular testicle
    - U/S = complex avascular mass
  - Worsening L >> R pleural bloody effusion
    - Airspace dz on L sided better post thoracentesis
  - CT chest - minimized (lack of classic features)
  - Urine culture for TB
  - Orchiectomy for TB culture as outpatient
Case Presentation

- Outpatient (1 week later)
  - 2 + AFB seen in urine
    - AMTD + → M. tuberculosis in culture
  - Pleural fluid (ER visit)
    - No AFB
    - M. tuberculosis in culture (pan S)
  - Quad TB therapy started (INH/RIF/PZA/ETH)
  - Pulmonary TB not suspected
Case Presentation

- ER (Day 2 of TB meds)
  - ICU admission for hemorrhagic shock
    - Duodenal ulcer
  - Respiratory deterioration
    - New/sudden airspace disease
    - Query aspiration
  - Airborne isolation
Case Presentation

- CT chest/abdo/pelvis (vs. March)
  - Progression of pulmonary nodules
  - Ca$^{2+}$ hilar/mediastinal LN
    - Missed on prior CT
  - Diffuse colitis
  - Fat stranding/ascites/irregularities in omentum and mesentery
Case Presentation

- April 18 sputum 1+ AFB pos = TB
- April 19 pleural fluid TB + culture
  - AFB stain neg
- 5 sputum samples (May 1-7) negative for TB
  - 4 wks. of therapy
- Airborne isolation D/C Day 26 of therapy
Case Presentation

- ICU stay (8 weeks)
  - *Pseudomonas aeruginosa* CR-BSI (May)
    - +/- VAP from trach colonization
  - *C. albicans* CR-BSI (May)
  - *MRSA* CR-BSI (June)
    - Colonization from May 4
    - Positive BC x8 days despite line changes & IV Abx
  - IV steroids for sepsis
Case Presentation

- Vesicular rash noted by resident
  - Active MRSA bacteremia
  - Purulence to the fluid
  - MRP not notified x 72hrs
- Reviewed by ID
  - Primary VZV vs. disseminated shingles
  - Airborne isolation & IV acyclovir
  - Viral culture = VZV
- Patient expired day 5 of rash
Epilogue

- 18 days later...
  - Patient’s adult offspring x2 – primary VZV
  - Prior immunity for any adult case unknown
  - No known ill family prior to index case
  - Unknown if pediatric vaccinations or exposure to mild case in patient’s grandchildren

- Summary
  - Extrapul. → pulmonary disseminated TB
  - Nosocomial VZV in ICU with transmission
“Clinical” Decision Making

- Diagnostic errors are estimated at 10-15%
  - Missed, incorrect or delayed
  - Undifferentiated syndromes
  - ICU/ER, Family/Internal Medicine
- Systems and/or individual causes
- Downstream effects on therapeutic decisions
- Raise risk for adverse outcomes

Pennsylvania Patient Safety Advisory. 2010; 7(3):73-86
Individual Decision Making

- Various process errors with info stream
  - Availability $\rightarrow$ assimilation $\rightarrow$ cognitive analysis
- Common scenarios are mishandled
  - Errors due to reasoning process $>$ knowledge
  - Different than rare events (missed/delayed)
- Freq. association with overconfidence
  - Little insight with one’s own error rate/magnitude

Pennsylvania Patient Safety Advisory. 2010; 7(3):73-86
Thinking Deconstructed

- Reasoning based on cognitive processes
- Psychological research – 2 speed motor
- Involve different areas of brain
  - MRI can visualize unique processes
- Different pros/cons
  - Healthcare is probability heavy
  - Proper application needed
  - Dictated by complexity/experience/personality

Mob Mentality

Type 1

Type 2
Type 1 – Cavemerson Circuitry

- Heuristic/intuitive
- Quick & reflexive
- Subconscious process
- Hard wired or from repetitive exposure
- Ubiquitous usage
- Indispensable
- Pattern recognition

Pennsylvania Patient Safety Advisory. 2010; 7(3):73-86
Type 2 – Modern Day Marvel

- Controlled/analytic
- Slow/deliberate
- Conscious process
- Requires practice & active engagement
- Limited use in daily life
- Logical & reliable
- Probability based “fits”

Pennsylvania Patient Safety Advisory. 2010; 7(3):73-86
Diarrhea Plus *C. difficile* toxin B PCR +

<table>
<thead>
<tr>
<th>Type 1</th>
<th>Type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>• It is <em>C. difficile</em> colitis</td>
<td>• Disease vs. colonization</td>
</tr>
<tr>
<td></td>
<td>• Other causes of diarrhea</td>
</tr>
<tr>
<td></td>
<td>• Duration in hospital</td>
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<td></td>
<td>• Abxs</td>
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<tr>
<td></td>
<td>• Stooling pattern</td>
</tr>
<tr>
<td></td>
<td>• Supporting lab/clinical features</td>
</tr>
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<td></td>
<td>• Pre test probability</td>
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</tbody>
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Type 1 – Downsides

- Most error prone
  - Cognitive biases
  - Fallacies
  - False assumptions
- Error rate magnified
  - Time pressure
  - Perceived simplicity
  - Personality traits
- “Gambling”

Pennsylvania Patient Safety Advisory. 2010; 7(3):73-86
Type 1 – Downsides

- Outdated ancient tool
  - Complex risk assessments
  - Information heavy
- Primitive roots makes it hard to “turn off”
- Unaware of when it errors

Pennsylvania Patient Safety Advisory. 2010; 7(3):73-86
Type 2 – Downsides

- Takes too much “CPU time”
  - Not the primary tool
- Fails differently
  - Wrong logic paradigm
  - Too much throughput
  - Tired/sleep deprivation
  - Emotions
  - Communication error

Pennsylvania Patient Safety Advisory. 2010; 7(3):73-86
Cognitive Bias

- Heuristics = simple decision making rules
- Periodic faulty application of heuristics
  - Over-utilized Type 1
  - Overrides Type 2
  - Differs from systematic effect of personality
- Occurs at any point in reasoning process
  - Commonly > 1 involved
- Type 2 tends to be protective

CMPA Perspective Dec 2012; 4(5):8-9
Anchoring Bias

- Focusing on 1 possibility & failing to consider others
- Despite contradictory information

- Thought that effusion/case was not TB
  - Renal failure/improvement on diuretics
  - Age = cancer
  - Bloody lymphocytic pleural fluid
  - Prior pathology result (testicle)
Representation Heuristic

- Match current to past patterns
- Limits ‘differential diagnosis’ created
- Probability of fit ≠ probability of diagnosis
  - Insuff. pattern recognition for rare diagnosis

- CHF/cancer was more likely with a mild chronic outpatient presentation
Premature Closure Bias

- Abrupt narrowing of possibilities too early
- True answer removed from consideration

- Rash in ICU discounted as persistent MRSA bacteremia related – no swab/action taken
- TB culture (pleural) negative initially

CMPA Perspective Dec 2012; 4(5):8-9
Search Satisfaction Bias

- Incomplete assessment once 1 abnormality is found
- Abnormality may not be germane to the problem
  - Orchitis vs. big picture
  - AFB seen in urine but sputum not re tested
    - To determine contagiousness

CMPA Perspective Dec 2012; 4(5):8-9
So Why Am I Boring You...

- Clinical assessment - 2\textsuperscript{nd} most common error
  - Linked to cognitive misfires
- Analysis of 100 errors in Internal Medicine
  - 65\% - system factors
  - 75\% - cognitive factors
  - 50\% - both
  - Average of 6 factors per error
- Harm is associated with some errors

Schiff \textit{et al.} Arch Intern Med. 2009; 169(20):1881-7
Slow Adoption

- Growing recognition to explain human errors
- Historic emphasis on fixing systems
- Other professions more aware (i.e. aviation)
  - Reduce human error
  - Redesigning training/processes
- Literature for medicine not robust
- CMPA alerting members

Pennsylvania Patient Safety Advisory. 2010; 7(3):73-86
So Why Am I Boring You...

- ICPs rely on MDs for crucial information
  - MDs are not perfect
  - Spot the trouble/discordance
    - Clinical vs. IPAC “diagnosis”
  - Avoid/minimize propagation of errors
  - Maintain standardized approach
Physician Scouting Report

- Limited data
- Most common causes of errors
  - Cognitive bias – anchoring, framing, info
  - Tolerance to uncertainty
  - Aversion to ambiguity

Physician Scouting Report

- Diagnostic inaccuracies/overconfidence
  - Anchoring, availability, information bias
- Management errors
  - Anchoring, premature closure, confirmation, representation bias
- Overutilization of resource
  - Less comfort to uncertainty
- Optimal management
  - More tolerance to ambiguity

Confirmation Bias

- Find/utilize data that supports one’s idea
- Ignore data that refutes one’s idea

- Use of insensitive (pleural) fluid AFB stain or culture to r/o TB
  - Despite TB risk factors

Pennsylvania Patient Safety Advisory. 2010; 7(3):73-86
Aggregation Bias

- Data/recommendations derived from the “average case” do not apply to a specific situation
- Despite the clear fit
- “Anti generalizability”

- “My patient is sicker”
- Hand hygiene
- Droplet/contact when NPS ordered for ARI

So Why Am I Boring You...

- ICPs make “surveillance diagnosis”
  - Clinical history
  - Risk factor examination
  - Diagnostic/laboratory test ordering
  - Decision on IPAC measures (“therapy”)
- Parallels to the physician
- Forced onto Yes or No outcomes
  - Despite probabilities
Bias Prone Areas

- Battle consistency for scrutinized decisions
  - Sensitivity – outbreaks
  - Specificity – outcome reporting
- Not blinded – normally a safe guard
  - Assess outcomes → assign consequences
  - Standardization hard maintain with human factors alone
  - Do we solve outbreaks or judge their resolution?

Bias Prone Areas

- Reproducibility of definitions (i.e. HAI-ESBL)
- Constraints on accuracy
  - Yes/No outcomes in complex world
  - Case finding when no easy flag
- Desirability
  - Consequences of public reporting
  - Case assessment when results were criticized
    - Excessive specificity in future
  - Belief that one’s intervention have worked

Affective Bias

- Unconscious emotional reaction to situation
- Interferes with proper decision making
  - Esp. during periods of uncertainty
- Not a cognitive bias

- Reverse isolation
- Excessive response given aversion to outbreaks

CMPA Perspective Dec 2012; 4(5):8-9
Framing Effect

- The context of how an event was presented can result in different decisions
- Without changing the facts
- Heightened during uncertainty or when emotionally charged

- Minimizing the infraction around device reprocessing affects risk assessment

Clustering Illusion

- Overestimating the value/significance of small blips in large random data sets
  - Esp. with small time frames
- Sensitivity at the cost of specificity
  - Cluster by chance or by design
- Can affect resource utilization

- SSI or CR-BSI rates
- Two nosocomial cases
The Fix In Is

- We are all guilty – insight needed
  - Impeded by personality traits/overconfidence
- Recognize risky situations
  - Actively promote a switch back to Type 2
  - Probability not perception
- Awareness of thought processes
  - “Decouple” from improper Type 1
  - Engage anti-bias strategies

Personal Goals

- Difficult to develop de biasing strategies
  - No single fix
  - Constant editing and re enforcement
  - Self customized solutions
- Learn to “engage purposeful self-regulatory judgment”
  - Efficient use of Type 2
  - Override misapplied Type 1
- Possible but lifelong project

Personal Goals

- Requires support environment
  - Raise awareness/educate
  - Introduce skills early in training
  - Embrace critical thinking
  - Work cognitive error prevention into processes
  - Review errors to create de biasing strategies
  - Avoid burnout for reflective decision review

Pennsylvania Patient Safety Advisory. 2010; 7(3):73-86
System Fix

- Standardized tools/checklists
  - Concrete definitions/discrete data elements
  - Objective criteria (easy to extract)
  - Readily (externally) audited for deviations
- External expert/group appraisal of bias prone events
  - Hand hygiene
- Separate surveillance & prevention tasks
  - Blinding
- Set realistic goals & action thresholds *a priori*

Exclusively for IPAC

- Zero Risk Bias
  - Reducing a small risk further (to zero) vs. greater reduction with a large risk

- “Bundled” interventions

*Association with the caption is purely coincidental*
Exclusively for IPAC

- Availability Bias
  - Easily recalled (weird/unusual) diagnosis
  - Distorts the true probability of the current event
  - How are rashes and testicular lesions to be viewed now?

*Association with the caption is purely coincidental*
Sunk Cost Fallacy
- Continued commitment/investment in an idea that is increasingly likely to be wrong
- Not wanting to abandon prior investment
- "Doubling down"
- <fill in example>

*Association with the caption is purely coincidental*
Summary

- Weird cases sets the scene for trouble
- Humans have 2 unique thought processes
- Type 1 thinking leads to medical errors
  - Cognitive bias
- IPAC departments can fall into these traps
- Remedies need to be sustained & multifaceted