

Andrew Klava FRCS FRCR FRANZCR ACEM winter symposium 2019 - Rotorua



OSCAR CRAIG

MEDICAL MEMOIRS





Sir Luke Fieldes, Tait Gallery, 1890 – "The Doctor"



"MEDICINE IS A SCIENCE OF UNCERTAINTY AND AN ART OF PROBABILITY" - SIR WILLIAM OSLER



"The good physician treats the disease; the great physician treats the patient who has the disease"

"Errors in judgement must occur in the practice of an art which consists largely of balancing probabilities"

- Sir William Osler



DOES DIAGNOSTIC IMAGING PROVIDE MORE CERTAINTY?









SO WHAT ARE THE LIMITATIONS?

- Technology improvements
 - Advanced detection
 - Disruptive technology
 - Technology pace vs appropriate clinical trials
- Increasing cost
 - New technology R&D/corporate profits
 - Increasing demand and expectations
- Clinical bias
- Changing clinical paradigm
- Are patient/clinician expectations being met
 - Yes & no
 - Is more better?
 - Is less more?
 - Is diagnostic uncertainty reduced?









DOES DIAGNOSTIC IMAGING PROVIDE MORE CERTAINTY?

- Paradigm A Doing more means doing better
- Paradigm B Doing more does not mean doing better

<u>Miller AB, Wall C, Baines CJ, Sun P, To T, Narod SA, Twenty</u> <u>five year follow-up for breast cancer incidence and</u> <u>mortality of the Canadian National Breast Screening Study:</u> <u>randomised screening trial. BMJ 348: g366</u>





All cause mortality, by assignment to mammography or control arms (all participants)

Breast cancer specific mortality, by assignment to mammography or control arms (all participants)





Breast cancer specific mortality from cancers diagnosed in screening period, by assignment to mammography or control arms

Fig 1 Trends in thyroid cancer diagnosis, use of imaging, treatment for recurrence, and death from thyroid cancer, based on SEER-Medicare data in 1998-2011.





Mousumi Banerjee et al. BMJ 2016;354:bmj.i3839

THE LANCET Respiratory Medicine

NEWS | VOLUME 1, ISSUE 6, P436, AUGUST 01, 2013

CTPA use reignites debate on overdiagnosis

Michael Granovetter

- 14 fold increase in CTPA requests (2001-2008)
- 80% increase in the diagnosis of PE
- No change in PE mortality
- Increased diagnosis of subsegmental PE
 - Only 1% "high probability" V/Q scans in this group
- Increased small clot detection with uncertain clinical significance.
- Problematic if treated
 - Cost
 - Iatrogenic risk
- Physiological normal filter





WHAT SHOULD BE APPLIED TO DIAGNOSTICS TO IMPROVE CERTAINTY?

- Take what we know
 - Clinical paradigm
 - Established test with know or estimated likelihood ratios
- Apply Bayes Theorem
- Modify pretest probability of disease
- Calculate post-test disease probability

Sounds complicated???



BAYES THEOREM

 "a theorem describing how the conditional probability of each of a set of possible causes for a given observed outcome can be computed from knowledge of the probability of each cause and the conditional probability of the outcome of each cause." – Oxford Dictionary



CONDITIONAL PROBABILITY AND PROBABILITY TREES







THE PREREQUISITES

- Knowledge of the patients condition pretest probability assessment
 - What does the clinical paradigm tell us?
 - Differential diagnosis?
 - Most likely diagnosis must occupy the likeliest probability spot (although diagnoses to exclude can be considered)
- Selecting the appropriate test
 - Understanding of the test
 - It's strengths and limitations test performance
 - Potential complications
 - Cost
 - Radiation dose
 - Coincidental findings
- Likelihood ratios should be relevant to the pretest diagnosis



There is plenty of information and resource to help us......







WHAT DO YOU NEED TO THINK ABOUT WHEN CONSIDERING IMAGING?

- Test performance
 - Must be relevant to the the pathology you are trying to diagnose/exclude
 - Sensitivity/specificity LR+/LR
 - LR+ = $\frac{\text{proportion of patients WITH disease who have a positive test result (SENSITIVITY)}}{\text{proportion of patients WITHOUT disease who have a positive test result (1 SPECIFICITY)}}$

• LR- = proportion of patients WITH disease who have a negative test result (1 - SENSITIVITY) proportion of patients WITHOUT disease who have a negative test result (SPECIFICITY)

Note:

- High quality diagnostic tests have LR+ > 10 and LR- <0.1 •
- A test with a LR+ or LR- = 1 is associated with no change in the post-test probability of disease and therefore is not diagnostically useful













Summary of Diagnostic Findings

	Sensitivity	Specificity	(+) LR	(-) LR
Decr Bowel Sounds (or high pitched "tinkling)	23 - 76%	88 - 93%	3.29 - 6.33	0.27 - 0.83
Abdominal Distension	62 - 67%	89 - 96%	5.64 - 16.8	0.34 - 0.43
Abdominal X-ray	75%	66%	1.6	0.43
CT Scan	87%	81%	3.6	0.18
Radiology US	90%	96%	14.1	0.13
ED US	97%	90%	95	0.04
2003	0770	00%	0.0	0.01
Clinical features	Likelih	ood ratio	> /	5
Clinical features Exaggerated bowel sounds	Likelih 22	ood ratio	0.0	001
Clinical features Exaggerated bowel sounds Abdominal distension	Likelih 22 10	ood ratio 2.059 0.768	0.0 0.0 0.0	001 001
Clinical features Exaggerated bowel sounds Abdominal distension	Likelih 22 10 9	ood ratio 2.059 0.768 0.324	0.0 0.0 0.0 0.0	001 001 002
Clinical features Exaggerated bowel sounds Abdominal distension Silious vomiting Constipation	Likelih 22 10 9 6	ood ratio .059 .768 .324 5.079	0.0 0.0 0.0 0.0 0.0	001 001 002 014
Clinical features Exaggerated bowel sounds Abdominal distension Bilious vomiting Constipation Midline laparotomy scar	Likelih 22 10 9 6 5	ood ratio 2.059 0.768 0.324 5.079 5.862	0.0 0.0 0.0 0.0 0.0 0.0	001 001 002 014 015

Symptoms and signs with significant plain abdominal radiograph findings in cases of intestinal obstruction

J Surgery, Nov 2005



SUMMARY

- Consider:
 - Is more less?
 - Is less more?
 - Are we truly reducing uncertainty
 - Apply "Choosing Wisely"
- Whilst technology advances are necessary, beware of accepting everything new at face value
- Apply critical logical thinking:
 - Start from a position of strength
 - The patient contains lots of information
- Don't get blinded by rarer diagnoses of exclusion:
 - You may apply the wrong test
 - The diagnostic outcome, conclusion and potential coincidental findings may dig a darker hole of uncertainty.

