REDUCING DIAGNOSTIC ERROR IN MEDICINE – IN APPLICATION

PAINTING BY THE NUMBERS: PHYSICIAN RELIANCE ON SINGLE TEST RESULTS LEADS TO ⬆ ERROR

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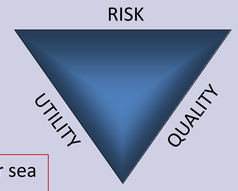


1. Clinician decision making based on single quantitative test results is often flawed. 2. The tendency to place too much significance upon a single slice in time ignores important trends and the patient's unique clinical circumstances. 3. A major sea change needs to take place in the culture of medicine to counter the adverse effects of a profession that does not see the patient as a complex system of systems that changes over time.

SITUATION

Where as there is a tendency for clinicians to expend enormous resources attempting to reach back too far when screening for subclinical disease, there is the paradoxical tendency to ignore clear cut preclinical trends in numerous inexpensive blood constituents that indicate the presence of a potentially treatable disease.

- ➡ This tendency is, in part due to our taking a very complex biologic system – the human body – and trying to reduce it to a single number for diagnostic purposes.
- ➡ This tendency is, in part due to our seeing the human body as static instead of dynamic with transitions between clinical steady states.
- ➡ This tendency is, in part due to our seeing test results within the "Normal" range as indicating health and visa versa when, in fact this means no such thing.

PROBLEM

How do we reverse this tendency towards over simplification to:

RISK	*Maximize patient safety* with correct and timely diagnoses, accurately communicated and acted upon
QUALITY	*Minimize* discomfort and the pain *suffered* due to wrong, delayed, or miscommunicated diagnoses
UTILITY	*Minimize expenditure* of scarce resources through improved cost effective diagnostic processes

SOLUTION

To significantly reduce diagnostic error that occurs due to a tendency to simplify we need to:

- ➡ Re-educate clinicians to establish long term trending with their patients
- ➡ Re-educate clinicians to avoid concluding that results within the reference range are "**Normal**" when they might not be **for that patient**
- ➡ Re-educate clinicians to avoid concluding that results outside the reference range are "**Abnormal**" when they might not be **for that patient**
- ➡ Re-educate clinicians to the present limitations of laboratory testing reliability
- ➡ **Re-educate our patients** regarding the limitations of medical science

THE PATIENT…THE PATIIENT…THE PATIENT…THE PATIENT…LOOK AT THE PATIENT!

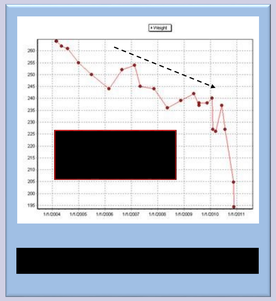
IMPLEMENTATION

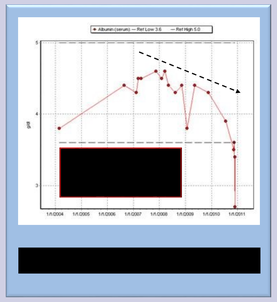
I have developed an intense 1 ½ hour tour of the lab for preclinical medical students. The tour consists of an introduction to all testing modalities with examples for:

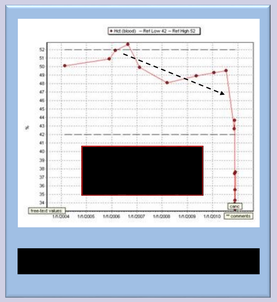
- ➡ How reference ranges are established affect interpretation of test results
- ➡ How instrument accuracy, and precision affect test results
- ➡ How both of the above affect the interpretation of any single test result
- ➡ How results outside the reference range can be normal for a specific patient
- ➡ How results within the reference range can be abnormal for a specific patient

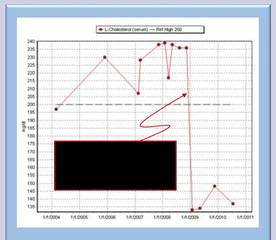
Emphasis is placed on the use of inexpensive urine dip stick, spun hematocrit and peripheral smear as a very powerful yet very inexpensive window into the patient's body. In addition, I emphasize extensive clinical consultation with the pathologist.

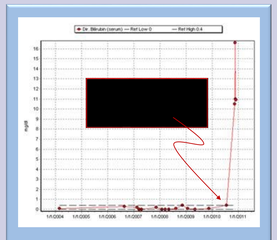
CASE PROGRESSION AND OUTCOME

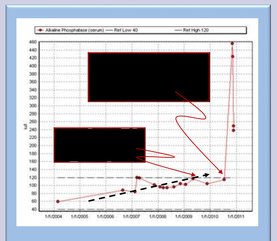


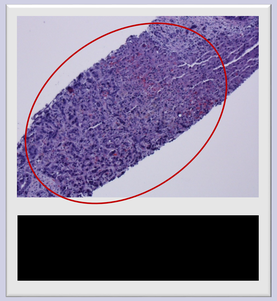


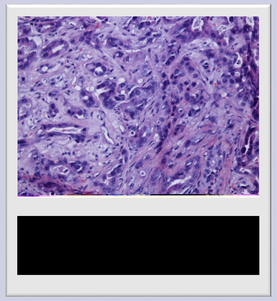


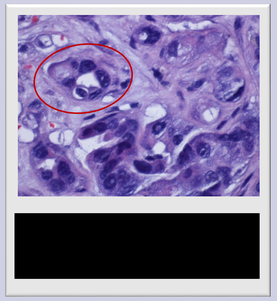












TOTAL COST OVER THREE YEARS TO ESTABLISH A TREND: ~$1,500.00

- ➡ $285.00 in laboratory testing plus physician time to evaluate
- ➡ $750.00 for three 30 minute physician visits with history and physical
- ➡ $450.00 additional administrative and billing overhead for three visits

COST BENEFIT ANALYSIS

The cost of not creating a chronologic visual compendium of a patient's key blood constituents often leads to:

- ➡ Delayed diagnosis
- ➡ Wrong diagnosis
- ➡ Diagnostic imprecision

This leads to ⬇ patent safety ⬇ quality of care and unnecessary ⬆costs.

For the cost of approximately $40,000.00 worth of one pathologist's yearly time, approximately 250 patient cases can be fully reviewed integrating clinical findings, radiologic studies, and laboratory results. This results in approximately 50 diagnoses identified. Although savings cannot be reliably measured the reader is well aware that they greatly outweigh the cost by ⬆ **SAFETY** ⬆ **QUALITY** and ⬆ **UTILITY**.

A CASE OF WITHIN THE 'NORMAL RANGE'

CC: 65 YEAR OLD OBESE HYPERLIPIDEMIC MALE COMPLAINS OF VAGUE ABDOMINAL PAIN:

- ➡ The pain is occasionally associated with eating and is mid abdominal
- ➡ History and physical fail to localize the pain and laboratory tests are "Normal"
- ➡ The original clinician discounted the complaint and did no further workup
- ➡ On and off over many years the patient raised the same complaint with progression of the pain
- ➡ Repeat laboratory tests were always "Normal"
- ➡ At one point, an ultrasound of the abdomen was carried out for "possible fatty liver"

RIGHT UPPER QUADRANT ULTRASOUND FINDINGS THREE YEARS AFTER FIRST PRESENTATION:

- ➡ Diffuse increased echogenicity with poor through-sound transmission
- ➡ No intra- or extra-hepatic biliary ductal dilatation is present
- ➡ The common hepatic duct is not dilated
- ➡ Multiple gallstones identified in nondilated gallbladder
- ➡ No pericholecystic fluid is identified

CLINICAL COURSE AT SIX YEARS:

- ➡ The patient presented to his physician with sudden onset of painless jaundice looking weak
- ➡ The patient had noticed he had "recently" lost a significant amount of weight
- ➡ Laboratory tests showed significant anemia, hyperbilirubinemia, and elevated alkaline phosphate
- ➡ CT of the abdomen revealed a large mass in the head of the pancreas with biliary obstruction
- ➡ A liver biopsy revealed significant metastatic disease

LEASONS LEARNED:

- ➡ For most of the six years the patient's laboratory values were within the "Normal Range"
- ➡ However, the trend was anything but "Normal" for a number of inexpensive analytes
- ➡ This constituted plentiful evidence that something was going wrong very early on
- ➡ Note there is very short period prior to final presentation where analytes breakdown
- ➡ Bilirubin is not a leading but rather, at most, a concurrent indicator and really a lagging indicator
- ➡ Look at cholesterol a year before the presentation in a hyperlipidemic person – Ahhh!

CONCLUSION

- ➡ Reliance on one or more single quantitative test results within a tiny slice of patient time greatly misleads us as to the presence or absence of disease.
- ➡ The patient must not be seen as a static system that can be described entirely by a single or even multiple quantitative test results taken out of context.
- ➡ Instead, the patient must be seen as a dynamic complex of interrelated system of systems where subtle trends, if recognized early, will allow us to:

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