The YEAR BOOK of

Nuclear Medicine®

1984

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Journals Represented

Acta Medica Scandinavica
American Heart Journal
American Journal of Cardiology
American Journal of Medicine
American Journal of Pediatric Hematology/Oncology
American Journal of Roentgenology
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Introduction

Speaking of Language

The language of medicine is often complex, sometimes pompous (only a patient can suffer from "eructation" and "flatulence"), and on occasion purposefully deceptive. It is a potpourri with roots in such diverse fields as mythology, philosophy, psychology, and the modern sciences. It remains for the clinician to try to integrate all of this into a meaningful method of approaching medical ailments. This never was an easy task and it is becoming progressively more difficult as new and unfamiliar terminology is added. The result is too often frustration and misunderstanding. Take, for example, the vocabulary of probability.

Much of modern concept in diagnostic imaging is based on Bayesean theory. Although I am not an expert on the subject, the theory (as I understand it with regard to its application to medicine) states that given the probability of a disease being associated with each of a series of findings (independent variables) and given the overall probability of the disease in the population being studied, the probability of the disease existing in a particular individual can be determined. Bayes' concepts were developed around the "science" of gambling. Indeed, Bayes, a minister by vocation, was sufficiently embarrassed by his work that it was not published until after his death. He wrote his work in the vocabulary of probability.

We, the intellectual descendents of Bayes, have taken his work and applied it to medicine sometimes with too little attention to problems of translation. It can even be argued that we, as diagnosticians dealing with only limited bits of clinical information, are already heavily committed and overly receptive to these concepts. Even our jargon . . . "when you hear hoof beats don't think of zebras" . . . betrays this attitude. I must admit that I am as much a victim of this addiction to the language of the odds as anyone. It is a medical environment in which one is measured by cups of coffee won and lost.

Therefore it came as a mild shock to me to read "The Art of Diagnosis: Solving the Clinicopathologic Exercise" by David Eddy and Charles Clanton.* This article is an analysis of the way in which a group of distinguished physicians approached the problem of making a medical diagnosis, and it involved a retrospective analysis of 50

*Eddy, D. M., and Clanton, C. H.: The Art of Diagnosis: Solving the Clinicopathologic Exercise. *N. Engl. J. Med.* 306:1263–1268, 1982.

clinicopathologic conferences from the *New England Journal of Medicine*. The major conclusions of this study are well summarized in the abstract: "The challenge of differential diagnosis is to select the most probable cause of a patient's condition, yet the size of the problem, the nature of medical information, and the notorious inability of human beings to manipulate probabilities in their heads all conspire against the diagnostician to make it virtually impossible to employ Bayes' theorem in routine diagnosis. Unable to estimate the desired probabilities explicitly, physicians recast the problem into a form that uses one of their most effective mental skills—that of comparing patterns. . . . The following six steps are taken to arrive at a diagnosis: aggregation of groups of findings into patterns, selection of a "pivot" or key finding, generation of a cause list, pruning of the cause list, selection of a diagnosis, and validation of the diagnosis."

Nothing in the article is really revolutionary. Many readers were probably impressed by the fact that the observations made by the authors are really formalizations of things they already know. But to me one feature is impressive and worthy of special attention. We as diagnosticians are frequently working in a professional world where a new language is used. This language includes not only the usual terminology of clinical medicine but also vocabulary borrowed from the field of probability. We ourselves use this combined vocabulary, and yet sometimes we forget to translate our thoughts from one form to the other. Worse than that, sometimes we are afraid to translate because the answer comes out "sorry you ordered this expensive test, but it hasn't helped either you or your patient."

Most nuclear medicine studies, because of their expense and sophisticated nature, are ordered because a certain diagnosis is suspected and the scan is the best way of "validating" that diagnosis. We see the findings—we correlate them with our experience and what we have read in the literature—occasionally we resort to a table, a book or an article to refresh our memory or learn—and, finally, we make a statement. Ideally that statement is in two parts, one descriptive of the findings and the other relevant to the diagnosis. It is in the second part of the statement that we may come to grief.

I find no fault with listing an appropriate differential diagnosis. In fact, it is not only important as an intellectual exercise but also of great clinical value. It may present diagnostic possibilities not previously considered. It is also useful for this differential diagnosis to be stated in some order of probability. However, just as the rest of clinical medicine has gone away from a workup based on differential diagnosis alone to one based on consideration of the patient's clinical problems, somewhere along the line we must come to grips with the problem which has been posed by the clinician: Is it what I thought it was (did you confirm my clinical judgment), or is it something else? Can you give me an answer to my question? If you can't, who can?

In this setting, statements like "the lung scan is indeterminate" are

communication disasters unless they are followed by some more clinically oriented advice. This advice may come in the form of the suggestion that a pulmonary angiogram be done or that a test period of anticoagulant treatment be followed by a repeat scan. I'm not even sure that this advice is best handled by a written statement. A direct conversation with the referring physician is usually preferable. The point to remember is that while Bayes' theorems may be great for predicting diagnoses and while medicine may live by the laws of probability, we must translate the terminology of probability into words that are clinically useful and understandable.

Aunt Minnie's visits may be predictable, but she's going to be damned mad if she comes to town and we're out betting her hard-earned money at Hialeah.

PAUL B. HOFFER, M.D.

Apologies

After getting all worked up about names last year, guess what? I misspelled John Freitas' name in the article! Sorry John—but I'm sure a lot of people got a good laugh out of it at my expense.—P.B.H.

CEREBRAL PERFUSION IMAGING

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Introduction

Regional brain perfusion can be assessed with either dynamic or equilibrium imaging using diffusible or extractable tracers.[1] Methods using positron radiopharmaceuticals are limited to a few centers because of the need for costly on-site cyclotrons and radiochemical and radiopharmaceutical support. Techniques that use single-photon radiopharmaceuticals and are free of high technology costs could have widespread clinical utility. Inhalation techniques that measure regional cerebral blood flow (rCBF) in human beings using radioactive xenon and stationary detectors have a number of inherent limitations: (1) the tracer is distributed to both the cerebral and extracerebral circulations; (2) artifacts are introduced due to large amounts of tracer in the upper airway; (3) flow to overlying tissue in the same field of view cannot be separated, and (4) there is substantial Compton scatter.[2] A tomographic approach overcomes some of these effects. Using a modification of the single-photon emission tomograph devised by Kuhl and Edwards,[3] Lassen and co-workers have shown that dynamic flow imaging is clinically feasible with single-photon tomography.[4] This technique has the advantage that measurements of rCBF can be performed sequentially, providing quantitative regional flow measurements in rapid succession. This approach would have its greatest advantage where acute changes in flow or physiologic interventions need to be measured. The major disadvantages of this method are the poor spatial resolution and the need for expensive, special-purpose instrumentation.

The extractable tracer approach using multidetector tomographic devices or rotating gamma cameras is more promising for widespread clinical use now that a family of amines have been developed that accumulate in the brain proportional to cerebral blood flow.[5–9] These amines are lipophilic, moving across the blood-brain barrier with almost complete extraction during a single passage through the cerebral circulation. Once inside the brain, they are either bound to nonspecific receptors or metabolized to nonlipophilic compounds. As a result, these tracers do not redistribute within the brain for at least an hour after intravenous injection. Because these amines can be labeled with iodine-123, scinti-