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CE - CLINICAL NOTES

Understanding and improving decisions in clinical medicine (II): making sense of reasoning in practice

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The role and limits of logical principles

The most refined logical model for clinical reasoning is the combination of Bayes' theorem and expected utility theory. Briefly put, it implies that the probabilities of an exhaustive list of initial diagnostic hypotheses be updated through the collection of data, and that treatment for a condition becomes justified when the probability of such condition exceeds the threshold where expected clinical benefit outweighs potential harm [1].

The theoretical virtues of this model as a benchmark of rational thinking are not in question, in our opinion. In a "logic-plus-error" view of human reasoning [2], one would go further and rely on this model as a major tool for understanding and improving actual decision making in medicine. Yet, as tempting as it may be, this approach provides insufficient guidance to address many pressing issues arising from clinical practice. As an illustrative example, we will discuss a recent report concerning the case of a 35-year-old woman with a chronic history of diarrhea and malabsorption associated with severe gastrointestinal dysmotility that was left with no diagnostic explanation for approximately 20 years [3]. The key to the resolution of this case was the serendipitous detection of blepharoptosis, a clinical sign that had been present for a long time, but never appreciated. A thorough revision of the case in light of this finding (with a stronger emphasis on neurological signs), eventually allowed the clinicians to identify a rare genetic disorder, named mitochondrial neuro-gastrointestinal encephalomyopathy (MNGIE), known from the scientific literature since the 1990s.

In this case, the patient suffered from a chronic problem of malabsorption without a satisfactory interpretation. After two decades, a rare condition with a dismal prognosis turned out to be involved. Is the rarity of this disease sufficient to explain the belated diagnosis? How did the physicians handle this case over the years? What prevented them from achieving a diagnosis? And what eventually allowed the correct conclusion to emerge? While there is no easy route to a definite answer to these questions, we mean to point out that a cognitive science approach to clinical reasoning offers a better framework for analysis than a logic-plus-error view.

Blindness of the clinical eye?

Consider the crucial clinical sign of eyelid ptosis. A drooping upper eyelid was noted on the third week of hospitalization by a physician, who was struck by a facial similarity between the patient and another woman recently admitted for myasthenic crisis. When queried, the patient and relatives reported that the suspected eyelid ptosis was steadily present since adolescence. However, this clinical sign had never been reported in earlier documentation.

Why was this element missed by the clinicians for years? The relevant phenomenon is called "inattentional blindness," in the cognitive science literature. The

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"invisible gorilla" is a widely known illustration [4]. In this seminal study, a short video is shown with a few people playing basketball. Meanwhile, a person dressed up as a gorilla crosses the basketball court, standing right at the center of the scene for a few seconds. However, posing a specific question to participants at the beginning (for instance, to count how many passes the black team was making) is sufficient for at least half of them to neglect entirely the presence of the gorilla. Only once they are informed, they are able to "see" how evident it was in the video.

From a common sense perspective, it is all too easy to think of our observation as a largely faithful recording of the surrounding world and overlook how fragile, selective, and context-sensitive attention and perception may be. But inattentional blindness has been documented in the medical domain [5], too, and is likely to be involved in our case above. Clinicians considered and put to test a long list of diagnostic hypotheses, including celiac disease, Whipple's disease, HIV, TB, Clostridium difficile, autoimmune disorder, IBD, pancreatic insufficiency, anorexia nervosa, and more besides. This process, although explicit and diligent, was clearly focused on a few salient aspects of the clinical picture (such as diarrhea and malabsorption), and may thus have prevented the detection of a plain clinical sign that appeared unrelated in that perspective. In fact, much as with the gorilla, no clinician questioned the eyelid ptosis once it had been pointed out, suggesting that the problem was cognitive, and not due to lack of sophistication or knowledge.

The relevance of cognitive processes

One element that might have allowed a more timely diagnosis in the MNGIE case was widespread dilatation of the gastroenteric tract as seen by a CT scan during hospitalization. In hindsight, it is easy to relate this datum to gastrointestinal dysmotility, but clinicians are likely to have interpreted the finding as a consequence, rather than a cause, of malabsorption. This illustrates a key aspect of so-called "confirmation bias," it is often quite easy to reconcile a potentially dissonant sign with one's current perspective, especially if the relevant alternative explanations are not being explicitly considered. *Prospective hindsight* has been suggested as a relatively simple but important cognitive strategy to mitigate this source of error. It consists in deliberately imagining finding out later that our current judgment is wrong, and looking for already available cues (such as a massive gastric dilatation) that might be identified afterwards as the red flags that were missed along the way.

Notice how such a strategy works. On the one hand, it has to be deliberate and reflective, as it requires awareness of the risk of cognitive error to be triggered in the first place. However, and importantly, it does not amount to an attempt to reframe the whole clinical problem according to ideal and general logical principles. Rather, it counters a potential bias by exploiting locally a cognitive mechanism that is of the same kind of the intuitive and spontaneous biasing tendency, namely: to see more clearly how a datum could reveal the weakness of a hypothesis, review the evidence while pretending you know that hypothesis to be mistaken.

One important reason why specific "debiasing" techniques such as prospective insight can be crucial for clinicians in their practice is that slow and analytic thinking, even when feasible, is not by itself sufficient for accurate judgment and good decision making. Unlike optimal models of idealized rational agents, the processes of the human mind may well lead to very careful search in the wrong place, (this was clearly the case in the MNGIE episode). Conversely, the insistence that cognitive heuristics can only bias clinical reasoning is also simplistic. In fact, the detection of the neurological abnormality that represented the turning point of the diagnostic process with our patient was supported by a combination of expert pattern recognition and an occasional effect of cognitive availability (the occurrence of a similar sign in another patient recently admitted). A piece of associative thinking such as this one might have been misleading, and surely sometimes it is. However, when one is running out of plausible explanatory hypotheses, even just being open to a serendipitous association may be a key step to expand one's outlook, and solve a hard clinical case.

Key points

- Sophisticated logical models of optimal behavior are indispensable analytical tools, but not sufficient to understand and improve clinical reasoning in practice.
- In order to be effective, debiasing strategies (like prospective hindsight) must dovetail and exploit our knowledge of how clinical reasoning works in the real world.
- The notion that cognitive heuristics can only bias clinical reasoning and that reflective thinking guarantees better outcomes is simplistic.

Compliance with ethical standards

Conflict of interest The authors declare that there is no conflict of interest.

Statement of human and animal rights All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with human and animals performed by any of the authors.

Informed consent None.

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