

The role of heuristics, which are mental shortcuts in reasoning, in diagnosis in practice is unclear as they have been described as facilitating diagnosis as well as causing diagnostic errors (1). In this paper, we shall analyze the process of diagnosis in practice to find out if and when heuristics facilitate diagnosis and/or cause diagnostic errors.

We start by examining the process of diagnosis of the disease acute myocardial infarction (MI) in practice.

This process usually starts when a patient presents to us with chest pain which may be typical or atypical for acute MI. The first step taken by us is to suspect acute MI in this patient based on the resemblance of this patient to patients with acute MI seen by us in the past, some of whom had typical and some others atypical chest pain. These patients seen by us in the past serve as exemplars (2), so to speak, for the current patient.

This step of suspecting based on resemblance is a mental shortcut, that is, it is a heuristic, as there is no logical connection between what is happening in the current patient and what has happened in patients seen by us in the past.

The heuristic of resemblance provides a bridge, so to speak, between our experience and the current patient which leads to a possible cause of illness in the current patient.

As suspected acute MI is only a possibility, it is formulated as a diagnostic hypothesis. The heuristic of resemblance only makes us suspect, not infer acute MI in this patient.

The role of heuristic of resemblance in generating the diagnostic hypothesis of acute MI is extremely valuable as we now know what to look for.

We look for acute MI by performing a test, an EKG. If we observe acute ST elevation EKG changes with likelihood ratio (LR) of 13 (3), we interpret it as strong evidence as it leads to an accurate inference of acute MI with the high frequency of 85 percent (4). Based on this strong evidence, we infer acute MI to

be present in any patient regardless of whether the presentation is typical or atypical.

This process of diagnosis in practice is based on the frequentist method of inference, which we have described in detail recently (5).

We note the heuristic of resemblance plays an absolutely essential role in making us suspect a disease from a presentation, without which diagnosis would not be possible in practice.

We do not find a heuristic to be a source of diagnostic errors in the process of diagnosis described above. This finding appears to be at odds with the claim made by some investigators (6) that heuristics are an important cause of diagnostic errors in practice. We shall now examine this claim in some detail.

This claim appears to have been made on the basis of applying experimental findings of Tversky and Kahneman (7) henceforth called T & K for brevity, about judgment under uncertainty. They studied several heuristics, but we shall discuss only one, representativeness, the most well known heuristic studied by them, to keep our discussion simple.

They performed several experiments about this heuristic. In a typical experiment, for example, subjects were provided a description of a person being a typical lawyer as well as information if he belonged to a group of persons with a high percentage of lawyers or to a group with a low percentage of lawyers.

The subjects were then asked to assess the probability of the person being a lawyer.

They found nearly all subjects to assess this probability from the description of the person being a typical lawyer while ignoring whether he belonged to a high or low percentage lawyers group.

This assessed probability was rightly considered to be erroneous as the base rate of the person being a lawyer was ignored in this assessment. This error was attributed to the heuristic of representativeness or resemblance of the person to a typical lawyer being employed by the subjects.

This experimental finding has been applied to diagnosis to claim that the heuristic of representativeness is a cause of diagnostic error.

We shall now examine the process of diagnosis described earlier to see if and how this heuristic could cause a diagnostic error.

We find that in the first step of suspecting a disease, the heuristic of resemblance (representativeness) actually helps us suspect a disease. This heuristic has been described as being responsible for our failure to suspect a disease with an atypical presentation (6). We believe this not to be the case. Instead, we suggest this failure is due to lack of experience in encountering various presentations, including atypical ones in different patients (8).

In practice, a test is performed to evaluate a suspected disease while testing is not a part of the experiment of T & K.

In practice, a disease is inferred from a highly informative test result in the frequentist method and not from probability of a disease (5). Therefore an error made in assessment of probability of a disease due to heuristic of representativeness has no relevance to inference of a disease in practice and thus this heuristic could not be a source of diagnostic error.

The experiment of T & K differs totally from diagnosis in practice as it does not include two key features, suspecting and testing, of diagnosis.

The experiment merely shows we make an error in assessing probability of an event due to influence of a heuristic. But simply assessing probability of a disease is not what we do in diagnosis.

In diagnosis, heuristics play a key role in making us suspect a disease without which diagnosis would not be possible. This role of heuristics does not lead to diagnostic errors as a heuristic generated suspected disease as a diagnostic hypothesis is always subjected to tests.

We shall now present a real patient discussed in a clinicopathologic conference (CPC) in which high level heuristic reasoning was instrumental in reaching a correct diagnosis (9).

The patient was a 65 year old grandfather who presented with bilateral pulmonary infiltrates and had no obvious risk factors for HIV disease. But the discussing physician suspected HIV disease in this patient because as she stated ' It is Arthur Miller's play Death of a Salesman that suggested to me a risk factor in this retired salesman, he is human and affairs are common.'

These suspected diseases, which were confirmed by testing, were suspected, we believe, due to the heuristic of resemblance, which suggested to the discussing physician that the patient in CPC, who was a salesman, perhaps resembled the salesman in the play in having affairs.

What this heuristic did, in our view, was to project the known behavior of salesman in the play having affairs on to the unknown behavior of the salesman in CPC which suggested he may be having affairs as well and thus had a risk factor for HIV disease.

We believe, this heuristic played a crucially important role in reaching the correct diagnosis in this patient.

The manner in which a heuristic is employed in diagnosis to suspect a disease is consistent with the traditional view of a heuristic as a method of discovery (in Greek, *heurisken* = to discover) (10).

The goal in the experiments of T & K is to assess a probability which leads to an error when a heuristic is employed. If these experiments were structured so that the goal would be similar to that in diagnosis, we believe, a heuristic would be employed in them like it is employed in diagnosis.

For example, if the goal in the lawyer experiment was to find out if the person is a lawyer or not, given the typical description, then the description would be employed to suspect if the person is a lawyer. A test may then be performed to find out if this suspicion is correct, for example by asking the person about the journals he subscribes to. If the monthly Law Review is one of these journals, we would correctly infer him to be a lawyer regardless of his base rate of being a lawyer.

In this experiment, we are employing the heuristic of resemblance precisely how we employ it in diagnosis.

The bottom line, we believe, is that the experiments of T & K are so different in their goal and setup from diagnosis that the role that heuristics play in them cannot be applied to diagnosis to say that heuristics are a source of diagnostic errors.

We fear the incorrect notion of heuristics as a source of diagnostic errors based on experiments of T & K may inhibit physicians from employing heuristics to suspect a disease during diagnosis in practice and thus prevent accurate diagnosis.

We have discussed heuristics only in this paper, even though they have been lumped with cognitive biases in most discussions, as we believe there are important differences between these two concepts. We shall discuss the role of cognitive biases in diagnosis in a separate paper.

In conclusion, we have argued in this paper that heuristics play an essential role in making us suspect a disease during diagnosis. The erroneous notion of heuristics as a source of diagnostic errors has arisen from an incorrect application of findings in experiments of T & K in which the goal and setup are very different than in diagnosis.

References

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