Review

Logical Fallacies in the ICU

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SUMMARY

Medical reasoning, the method of solving clinical problems, is the foundation of all the decisions physicians make, aiming to understand the illness and arrive at the appropriate therapeutic decisions. Interaction among different physicians and exchange of opinions may often lead to disagreement with respect to the diagnostic or treatment priorities. The quality of the arguments presented comes in focus, making it necessary to be aware of and familiar with the logical fallacies, i.e. flawed ways of reasoning. Some of the more commonly encountered types of fallacies are described, along with examples to help clarify their substance. Logical fallacies can have a toxic effect, leading to improper medical decisions. Safeguarding medical reasoning is of paramount importance; adopting a critical method, actively seeking to identify erroneous arguments by asking appropriate questions is presented. Awareness of the presence and the features of flawed reasoning is a profoundly important skill for all physicians, an integral part of our ability to process clinical information efficiently and correctly.
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INTRODUCTION

Routine medical practice is based mainly on intellectual procedures, including the search for facts and clues, in order to arrive at correct decisions regarding the management of our patients' clinical problems. This process comprises the collection of data from the patient's medical history, physical examination and the appropriate laboratory and imaging examinations. Understanding the pathophysiology, reaching the correct diagnosis and developing a treatment plan are the ultimate goals of this endeavour.

The method of approaching and solving clinical problems is what we call **medical reasoning**. This term signifies a qualitative investigation that studies the cognitive and mental procedures leading to therapeutic decisions[1].

Additionally, the significance of the interaction among the different physicians involved in a given medical case should not be disregarded, for it plays a major role in the shaping of diagnostic and therapeutic decisions,

since each of them brings to the case his/her own particular medical experiences, knowledge (especially when different medical specialties are involved), judgment, philosophy and mentality. Consequently, the investigation and related discussion of a given medical case may lead to disagreement with respect to both the most probable working hypothesis and the diagnostic or treatment priorities. The resolution of such conflicting situations inevitably includes the use of arguments and comparisons aiming to draw valid, reasonable conclusions upon which to base the medical decisions.

At this point, attention should be focused on the quality of the arguments presented in order to ensure the correctness and validity of the ensuing conclusions. And this is the main reason why one should be aware of and familiar with what are known as **logical fallacies**.

But what is a logical fallacy? In short, it is a flawed argument, a false, erroneous way of reasoning[2].

Why is recognizing logical fallacies important? Because they are dangerous. They are often difficult to detect in the course of a discussion, subtly infecting the process of argumentation, with misleading results. Their persuasiveness, their success, is due to failure to recognize and understand the structural flaws, unsound quality or inaccuracies that characterize them. Logical fallacies have been aptly likened to magic tricks or visual illusions.

A list of all the logical fallacies that have been described would be quite lengthy, numbering in the hundreds. For this presentation, we shall settle for describing some of the more commonly encountered types[3], along with some realistic examples that might come up in routine medical discussions to help illustrate and further clarify the nature of the fallacy described.

LOGICAL FALLACIES: TYPES, DEFINITIONS, EXAMPLES

Ad hoc fallacy:

Latin phrase meaning "for this (purpose)". This refers to an argument invoked when the facts appear to reject a hypothesis. The result is an explanation that lacks coherence and appears to be valid solely for a specific case, so that generalization of the argument's validity is impossible.

Example:

- In the end, it was the inhaled amikacin that cured the patient from the respiratory infection caused by a multi-drug-resistant Acinetobacter.
- But its use in other patients with the same strain was not as effective.
- Surely that has nothing to do with the antibiotic; the drug must have been incorrectly nebulized.

An ad hoc hypothesis is not necessarily false, but one must be wary when such arguments arise in a discussion.

Ad hominem fallacy:

This is essentially a verbal assault on the person making the argument, in order to undermine that person's credibility and, as a consequence, his arguments. In effect it is an attempt to reject a hypothesis on the basis of presumed shortcomings or weaknesses in the character, motives or capabilities of the person who supports the hypothesis facts rather than of facts disproving it.

Example:

- Doctor X maintains that we should administer corticosteroids to all patients in severe septic shock under high doses of vasopressors.
- Our colleague, Doctor X, is too young and inexperienced; we could do without his advice.

Appeal to authority:

This describes using a person's position, office or general standing to automatically validate and admit a proposition.

Example:

- Professor X holds that the use of non-invasive ventilation has no place in the management of ARDS; this, therefore, is the approach we should adopt.

Any reasonable scientist should accept a conclusion when it is sufficiently supported by evidence. The appeal to authority fallacy, however, leads to the opposite result; that is, considering a proposition to be true simply on the grounds of its being endorsed by an authority. One should always bear in mind that even authorities may be misled.

Appeal to fear:

With this logical fallacy there is an attempt to exploit the emotion of fear, not rooted in reason, as a means of influencing the judgement of others, forcing them towards a certain decision regardless of the evidence.

Example:

- If you choose not to administer triple antibiotic coverage for this patient with severe and extensive burns, you will be held responsible for any infectious complications that might eventually arise.

In this example, the use of triple antibiotic coverage might be considered to be a valid choice. Nevertheless, fear of possible complications and – particularly – of the risk of being held accountable for those complications,

should not form the rational basis of acceptance of our choice.

Appeal to possibility:

This is the fallacy of adopting a conclusion, relying not on the existing evidence but on *the possibility that something is true*. The trap to be avoided here, which requires special attention, is to not confuse the *possibility* of a phenomenon's happening with the *probability* that it will happen.

Example:

- We have decided not to place central venous catheters in the subclavian veins of our ICU patients, because we want to avoid the risk of causing iatrogenic pneumothorax.

In this case, it must be stressed that causing iatrogenic pneumothorax is certainly possible, but the *probability* of its occurring depends on various factors, including experience, anatomical abnormalities, etc.

Appeal to tradition (argumentum ad antiquitatem):

This describes misleading reasoning that arises from the acceptance that appealing to the ancient origin or historical pedigree of a proposition (that has been established as "tradition"), automatically justifies and validates the correctness of the proposition in question. Put more simply: "this is true, because we have always believed it to be true".

Example:

- I have no intention of stopping the use of somatostatine on patients suffering from acute pancreatitis. I consider it to be a very reasonable choice. After all, it has been standard practice in our department for many years and we've been quite satisfied with the results we've had.

The fallacy illustrated above contains two errors. On the one hand it presumes that the "traditional" premise is correctly established, having been adequately supported by evidence since it was first accepted – without considering the possibility of methodological errors or inaccuracies. On the other, it considers that the conditions justifying the adoption of the "traditional" proposition are eternal and unchanging, an assumption that could very well be wrong.

Appeal to common belief:

Also known as 'appeal to the masses', 'appeal to the majority' or 'social conformance'. Appealing to common belief is nothing more than an attempt to validate the correctness of a claim based on the fact that it is held to be true by many, or even most, people.

Example:

- In the hospital where I worked before, most colleagues considered measuring CVP as a necessary parameter to assess for guiding the administration of fluids in all our patients.

Argument from ignorance:

when it is asserted that a proposition is valid merely because it has not yet been proven false (or the person who supports the proposition has no knowledge of evidence disproving it).

Example:

- Measuring gastric residual volumes is indispensable in order to manage the administration of enteral feeding in critically ill patients. When these volumes exceed 200mL, the administration should be stopped.
- Are you sure? A gastroenterologist colleague of mine told me that even greater residual volumes can be well tolerated; he proposed that we carry on with the feeding, maybe with the addition of metoclopramide.
- To my knowledge, there are no studies supporting this approach. Therefore, I see no reason to change our routine.

In science, the validity of a proposition should be based on the positive evidence presented, not on the absence of facts that disprove it. A very useful quote by Carl Sagan comes to mind here: "Absence of evidence is not evidence of absence".

Begging the Question:

Also known as a 'vicious circle', or 'circular reasoning', this fallacy is a form of tautology where the validity of the conclusion is already accepted in the premises of a proposition.

Example:

- I view any discussion concerning the limiting of therapy as morally wrong, that is why I do not accept it.

The tautology in our example may be schematized as follows:

- The limitation of therapy is morally *wrong* (premise)
- I reject this choice because it is wrong

"Begging the question" is an *informal fallacy*, which means that there is no problem with the rational validity of the argument; rather, the argument is unpersuasive because its content is ambiguous, poorly supported, or of bad quality. In this specific case the person simply concludes the correctness of what is posited to be true.

Post hoc ergo propter hoc (after this therefore because of this):

This is a logical fallacy similar to the one just described (cum hoc ergo propter hoc), but which presumes that if event A is followed by event B, then the only explanation is that A was the cause of B.

Example:

- The administration of echinocandins in this patient has been a very successful choice. Fever has subsided, along with the rest of the septic manifestations, in less than 48 hours.
- Well, it seems so, but how can we be certain of it? I mean, there are no confirming cultures so far. Surely we should not dismiss other plausible explanations.
- The chronological correlation suffices for me. I am convinced it was a fungal infection.

With regard to both ***Post hoc*** and ***Cum hoc*** arguments, it must be stressed that **correlation does not always imply causation.**

False dilemma (false dichotomy):

This is a kind of informal fallacy, formulated in such a way as to present only two (or a limited number of) alternatives, thus obscuring the fact that there may be at least one more and possibly a wide spectrum of additional alternatives to be considered.

Example:

- Ogilvie's syndrome, also referred to as acute colonic pseudo-obstruction, is a very severe condition. If the administration of neostigmine is not effective in relieving the symptoms, then the only choice would be to immediately take the patient to the operating room. Otherwise, there is a very high risk of the patient's developing caecal perforation and peritonitis.

This example fails to acknowledge the existence of alternative treatments to neostigmine and surgery, e.g. correcting electrolyte disturbances, withdrawal of drugs that may induce the syndrome, or colonoscopic decompression. It should be noted, however, that although more alternatives may exist in ideal conditions, these additional choices are in practice useless when they are not readily available in a given situation (non-applicable due for example to absence of gastroenterologist, lack of appropriate instruments, etc.), in which case the choices are indeed limited and the argument is not faulty.

Straw man:

In this kind of fallacy the opposing proposition is distorted, for example through exaggeration or misrepresentation of the facts or arguments supporting it.

Example:

- Prone positioning holds a very important place in managing hypoxemia and lung protection in ARDS patients.
- So, if I understand the matter correctly, our colleague here wishes to persuade me that all patients suffering from ARDS should be managed with prone positioning, or else the outcome could be detrimental. Well, no, I do not accept this!

The 'straw man' argument in this case is a distorted proposition that appears to state that all ARDS patients should be treated with prone positioning. Thus, the manipulated thesis aims to replace the original one, rendering it more vulnerable to criticism and rejection.

Special pleading:

This is the attempt to defend a hypothesis and neutralize the rival arguments by appealing to the need for very specialized information, or "superior" knowledge in order to comprehend the hypothesis presented. In this fallacy, the point is to maintain that there are exceptional facts, which are hard to verify, that justify a hypothesis.

Example:

- I am convinced that the development of multi-organ failure that complicates septic situations largely depends on microthrombosis. That is why I advocate the use of drotrecogin alfa in severe sepsis.
- But, as you know, the Cochrane review looking into this matter concluded that there is hardly any benefit.
- I question the way the review was designed and presented. I believe that we have not fully comprehended the way this substance operates. But it is still a valuable drug in many cases.

It is evident from our example that 'special pleading' serves to mislead and avoid addressing the arguments opposing a hypothesis in a rational manner.

Equivocation:

This is a logical fallacy that is present when a word or a term with more than one meaning is used ambiguously, thus leading to incorrect or inaccurate conclusions.

Example:

- I think that the significance attributed to the so-called bacterial translocation and its importance in the emergence and progress of sepsis and multi-organ dysfunction is not convincing. Anyway, it's merely

a theory.

The error in the example above is due to the ambiguity of the word **theory**. It is common in everyday conversation to use it as a synonym for the word **hypothesis**. In science, though, the word **theory** is defined as a well-substantiated explanation of a phenomenon of the natural, with evidence acquired through the scientific method (observation, experimentation, repetitiveness, ability to formulate predictions and confirmation of these predictions).

An interesting related fallacy that is also worth mentioning is the **accent fallacy (fallacy of prosody),** when the sense of a phrase depends on where in a sentence the stress or emphasis is placed.

Example:

1. Measuring the dimensions of the inferior vena cava is **considered** significant in assessing the adequacy of the intravascular volume.
2. Measuring the dimensions of the inferior vena cava is considered to be **significant** in assessing the adequacy of the intravascular volume.

DISCUSSION

As can be seen, the term **medical reasoning** refers to the cognitive procedure leading to medical decision-making.

Proper application of medical reasoning in order to draw correct conclusions as to the diagnosis and treatment of patients requires a combination of data (history, physical examination, laboratory results) and medical knowledge (bibliography, research), which physicians use to try to interpret the pathology and determine the proper course of action to manage the problem.

The spectrum of interest in this field is wide, extending even to artificial intelligence applications. It is well worth considering the theoretical model proposed by Ledley and Lusted (1959)[4], who describe two stages of medical reasoning: a) hypothesis generation and b) hypothesis assessment. More specifically, analysing the method of medical reasoning, the authors discern the following four components:

- Information and data collection from the patient's history, physical examination and laboratory results
- Filtration and evaluation of the information collected and arrangement in order of significance from major to minor importance
- Compiling a mental list containing probable diseases, the signs and symptoms of which can adequately explain the available data
- Systematic analytical effort to limit the spectrum of differential diagnoses by eliminating the less likely causes, aiming to establish the identity of the disorder

We all know that the diagnostic process is not a dry, impersonal affair, a matter of pure calculation. The "feeling" a physician gets during his evaluation of the information and the data is frequently mentioned. This medical "feeling" appears to be beyond typical logical analysis, referring largely to the physician's accumulated experience, as well as to assessment of the credibility, the particular impact, the "specific weight" of every aspect of the information received (be it from the patient, his/her environment or from the various medical examinations).

Medical experience plays no small role: Patel et al. (2002) have demonstrated the superiority of experienced physicians over their younger colleagues, particularly in regard to narrowing down the range of probable differential diagnoses[5]; this advantage has been attributed to a more efficient, sophisticated approach deriving from a "sharper" evaluation of the information. The result is a more effective selection and highlighting of the most essential data, while simultaneously downplaying the less relevant facts.

Experience, the in-depth understanding of a subject, also influences the method of approaching and investigating clinical problems in another way. In their 1981 paper, Chi et al.[6] showed that those less experienced in a field tend to focus on the more superficial aspects of a matter. Experienced individuals, by contrast, direct their attention to the deep structure, trying to perceive the fundamental architecture and principles behind a phenomenon (e.g. laws of physics, principles of physiology) and the changes or disorders that may explain both the onset and the course of a problem.

A detailed and comprehensive analysis of medical reasoning and the diagnostic process is an extensive and very interesting subject, but one which is beyond the scope of the present study. Our interest here is focused on a careful scrutiny of the structure of an argument or proposition in order to detect potential rational flaws or misleading elements.

Everyday medical practice involves, on the one hand, contact with the patient, gathering the relevant information and evaluating it. On the other hand, doctors routinely discuss the diagnostic challenges and various possible therapeutic choices with colleagues in the same or another medical field. This interaction between scientists of

different specialties, background knowledge, individual expertise and level of experience is extremely useful. It serves to enrich the conversation, analyse and re-evaluate the facts, distinguish the essential from the secondary. In this way, the spectrum of differential diagnoses may be narrowed down, more accurate hypotheses may be formulated, and physicians may be helped to find more appropriate (or cost-effective) means to confirm or reject the hypotheses; thus, there is a higher probability of arriving at correct medical decisions, to the ultimate benefit of the patient. In other words, the strategy and the medical plan are worked out through dialogue and exchange of views among physicians of varied knowledge and experience.

Discussion constitutes a valuable tool in the medical arsenal that, under the proper conditions, acts as a positive multiplier of the efficiency of medical reasoning. Not only does the patient benefit from it, but it is also in the interest of all participants in the discussion of a medical case, since knowledge is increased and new experience is gained through a process of cross-fertilisation that extends and deepens our understanding. And it is precisely for these reasons that the quality of this process must be safeguarded.

So, what threatens the integrity and quality of the medical dialogue? Danger lurks in the form of faulty reasoning, the so-called **logical fallacies**, those unsound, pernicious, poor quality arguments used to support a logical position[2], sophisms based on questionable or false convictions that can sneak unnoticed into a discussion. They have a toxic effect, since they act to divert the attention or mislead. As a consequence, this type of argument is unable to adequately and rationally justify the conclusions desired by the person introducing the sophism. This, in turn, results in false or essentially unsubstantiated conclusions, with a strong likelihood of leading to improper decisions.

There is a wealth of resources (books - both specialized and popularized - as well as internet sites) one can explore, with extensive, comprehensive lists of the various fallacies (definitions, descriptions, examples) compiled and catalogued in a variety of ways. Of course, the sheer number of types of fallacies in those lists makes them extremely difficult to memorise, but fortunately, this is not necessary.

The key to safeguarding rational thinking and, in this context, medical reasoning from the undesired intrusion of logical fallacies lies in the adoption of a critical attitude towards all arguments presented. Sober evaluation of all separate elements in support of a proposition is imperative.

A highly recommended strategy for dealing with this challenge is to examine the rationale of a proposition by asking basic questions, with the aim of detecting the presence of sophisms. More specifically, the issues that should be addressed and clarified are[2]:

- What are the causes and the conclusions of the reasoning process?
- Which causes are really related to the conclusion?
- Do the causes (supposed to lead to the final conclusion) offer an obvious explanation to justify the conclusion?
- Assuming the causes are true, do they support the conclusion rationally?
- Are there false or unacceptable values or beliefs? (These are the – commonly unstated but implied – principles that are considered as generally accepted, which are indispensable in defining the very essence of a conclusion: for example, the desired conclusion for a given medical case is different depending on whether we choose aggressive management and full support of a patient or opt for palliative care.)
- Are there any emotionally loaded words or phrases that might mislead?

On the other hand, adopting a permanently suspicious attitude in one's interaction with fellow physicians is by no means desirable or helpful. In the vast majority of cases, there is no malevolent intent to deceive when these sophisms are used in an argument; rather, it reflects a sincere wish to support a specific diagnostic or therapeutic decision, of the value and correctness of which one is genuinely convinced. The fundamental common ground fellow physicians ought to agree upon is the preservation and improvement of the quality of scientific exchange and the sharing of opinion and information for the benefit of both the patients and the physicians themselves.

CONCLUSION

The preservation of a good quality medical reasoning and discussion depends, to a great extent, on the toxic risk posed by the unrecognized intrusion of false or unsound arguments: logical fallacies. We regard awareness of the presence and the features of this flawed reasoning as a profoundly important skill for all physicians, an integral part of our ability to process clinical information. A list of every type of logical fallacy would be very extensive. Our aim has been to present some of the most commonly encountered fallacies in critical care routine. Additionally, we strived to illustrate the form the fallacies may assume through the use of simplified examples.

It is obviously impossible, from a practical point of view, to memorize all the different names of the fallacies; fortunately this is not necessary. It is far more useful to adopt a healthy, carefully critical stance. Seeking the answers to appropriately formulated questions may decisively assist doctors to filter the arguments, assess their relevance, quality and validity, and to detect the flaws in the fabric of a logically constructed proposition. Identification of the error allows for more accurate conclusions and safer decisions. It also enables us to reject misleading sophisms, even if we do not know their official name.

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