EDITORIAL

Think about how you think about cases

Reaching a diagnosis in veterinary practice may seem fairly straightforward for an experienced clinician – most of the time. However, occasionally a difficult case comes along which not only leads to confusion, but undermines confidence. Why do we find some cases more difficult to diagnose than others? Have we been misled by the information provided by the client? Perhaps we have misunderstood the significance of, overlooked, or not asked for some piece of critical information? Confronted with a dyspnoeic cat, for example, did we forget to ask about any change in the meow? This might have alerted us to laryngeal cancer as the potential cause (Figure 1a).

Or is the difficulty in diagnosis because we have never seen a case like this before (Figure 1b) and can't think of a logical way to start the investigation? Conversely, is it because we have seen similar cases before, but this one turns out to be more complicated than we thought? Perhaps the presenting signs are due to a second or even a third disease process superimposed on the primary disease; not just diabetes mellitus, but pancreatitis and a bacterial urinary tract infection as well.

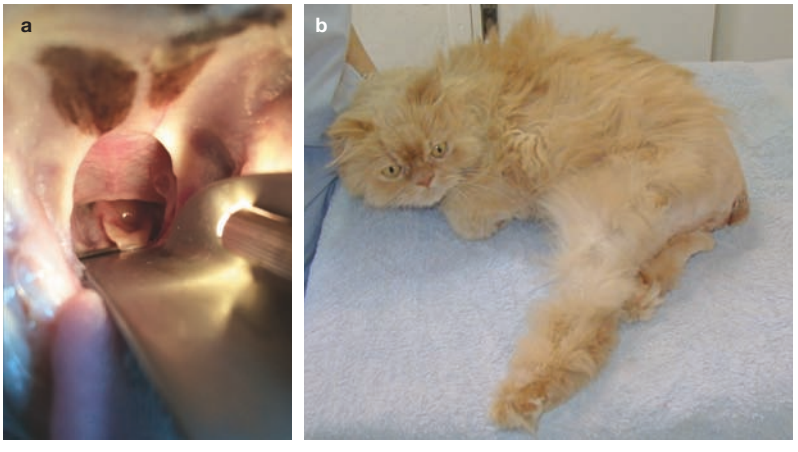

Figure 1 **(a) The first sign of laryngeal neoplasia in the cat is usually a change in the patient's meow, but owners will rarely volunteer this information unprompted. If the clinician misses this sign for whatever reason, and treats the cat for viral upper respiratory disease, the condition can quickly progress to life-threatening dyspnoea due to upper airway obstruction. An expert diagnostician – and one who has had previous experience with this type of case – will seek out this extra information by asking pertinent questions and then support the information with additional searches and further diagnostics. (b) The owner of this cat found it in this condition after it 'went missing' for 2 days. It has unyielding rigidity of the left hindleg but is otherwise well. What questions would you want to ask the owner? What tests would you perform to secure a diagnosis? Is this making your brain ache? (See Article 1 on pages 35–45.)**
Images courtesy of Orla Fitzpatrick (a) and Randolph Baral (b)

Maybe the case seems difficult purely because it is the first patient of the morning and we don't think well first thing. Possibly we just had an argument with our spouse or colleague and feel in no fit state to rationally tackle a complex case. Is it because we work on our own with no-one to bounce ideas off, or simply get bogged down in too much detail? Perhaps we have lost faith in our intuition (or never really had any in the first place).

These and related issues can all too easily give rise to diagnostic errors. In the medical literature, it is recognised that diagnostic error can be divided into three categories: (1) 'no-fault' error – due to unusual presentation of disease or deliberate or unknowing deception by the patient (client in a veterinary context); (2) system-related error – due to organisational or technical failures and bias leading to lack of results, delayed results, or false or misleading results; and (3) cognitive error (flawed or misleading thinking) – due to faulty knowledge, data gathering or synthesis.[1] This division is somewhat arbitrary, as there is some overlap between the categories and it can be argued that all three impact on clinical reasoning. However, what is indisputable is that all three types of error apply to veterinary diagnosis.

'No fault' error

How often have we been frustrated or confused by a sick cat not expressing any specific clinical signs, or presenting with misleading signs? Although this could be termed a 'no-fault' error, it is still difficult to overcome or avoid. It may be minimised by keeping an open mind and not over-emphasising the importance of detecting a key sign in starting along the diagnostic process. Indeed, some may find it liberating to know that in many cases there are no obvious clues, and that we need first to gather a larger amount of information in a non-discretionary manner (haematology, serum biochemistry panel, chest radiographs, abdominal ultrasonography, etc). In fact, some veterinary schools teach that this 'minimum database' should be obtained for every case. This is laudable in theory. Unfortunately – or perhaps fortunately for

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the purposes of developing clinical reasoning skills – it is beyond the financial resources of many cat owners. Moreover, a minimum database approach creates a dilemma (and sometimes cognitive overload) for inexperienced practitioners as they try and 'sift the wheat from the chaff' and decide which results are critical and which are spurious for a given case. As far back as 1922 it was advocated that supporting tests, especially laboratory tests, need to be selected based on clinical acumen and an understanding of their usefulness and limitations.[2] Undoubtedly this still has relevance today.

The impact of no-fault error related to client misinformation (or lack of information) is more difficult to minimise. This is where honing one's intuitive skills may be useful, especially if it is combined with empathetic and active listening leading to good questioning technique. Naturally, effective information-gathering in this veterinary setting requires adherence to the four cornerstones of good scientific investigation: objectivity, accuracy, scepticism and open-mindedness. Critically, all require a component of self-awareness, a key contributor to emotional intelligence. That component is often referred to as metacognition ('thinking about the way we think').

It is also important to understand how diagnostic thinking can be influenced and misguided by present mood, past experiences and personality. In essence, both nature and nurture influence the way we gather, process and analyse information for diagnosis. When this goes wrong, through whatever thought component, then we are left with uncertainty and lack of confidence.

System-related error

System-related errors can be equally frustrating in veterinary diagnosis. Reliance on machine accuracy and precision, and others' technical skills, is necessary for diagnostic testing, but both factors may at times mislead clinical reasoning. Avoidance of error may be out of our hands if tests are done elsewhere, but in-house testing can be managed by good training and appropriate machine calibration. For example, for those of us obsessive about accurate IRIS classification of kidney disease in cats, it pays to purchase a feline-specific refractometer, because if we rely on a conventional device that has been calibrated to suit human patients we may need to apply a correction formula to obtain the true value for the feline patient.[3]

An additional factor relevant to system-related errors is that often technical bias is included in the design of a diagnostic tool or test. This bias may simply be related to how commonly diseases occur; for example, a laboratory test for an infectious agent developed in a country that has a high prevalence of disease may not have as high a positive predictive value in a country that has a low prevalence of that disease. Technical bias may also be related to whose advice was pivotal in designing the test or tool; this, in turn, might be influenced by past experiences and what diseases occur commonly in their region.

Needless to say, confidence in outside testing is quickly destroyed by misleading results – that is, if we find out that they are misleading! Certainly when crucial results or their interpretation do not 'make sense clinically', we should question the validity of the result with our laboratory diagnostician. Might failure to grow bacteria seen in a wet urine preparation in the practice simply be down to delays in processing due to a slow courier network? In this circumstance, we shouldn't hesitate to contact the laboratory and find out how long the delay commonly is before specimens reach the laboratory and are plated out.

By becoming aware of how you like to think, and why this may sometimes lead to errors, you will become a better diagnostician.

Cognitive error

While all clinicians are urged to be mindful of the existence of no-fault and system-related errors in veterinary diagnosis, our focus is primarily on cognitive errors that occur as part of diagnostic reasoning. So much so, that we have collaborated with some greatly respected colleagues to produce an article series dedicated to the subject (see box on page 6). Yes, cognitive errors contribute to many misdiagnoses but here's the good news: there are general management strategies based on metacognition available in the medical literature on which we can draw ('cognitive pills for cognitive ills').[10]

For convenience, but not because of mutual exclusivity, the discussion on clinical reasoning has been divided into three articles. The overarching aim is to allow readers to explore and understand how they think and make case-based decisions when engaged in clinical reasoning. This is especially compelling in cases where things go terribly wrong. While it is unlikely that this will lead to an epiphany (although there's always hope!), we believe that it will allow readers to develop more confidence in diagnosing complex diseases. By becoming aware of how you like to think, and why this may sometimes lead to errors, you will become a better diagnostician. In essence, you will need to know more about your normal thinking

Outline of article series

The three articles in this series explore the two main forms of clinical reasoning that all veterinarians, knowingly or unknowingly, utilise to make a diagnosis. System 1 thinking is intuitive and unconscious (involving effortless recall of information, often in the form of patterns or 'illness scripts' from long-term memory).[4] System 2 is analytical, problem-oriented and data-driven forward thinking. This dual-process account of reasoning, which proposes that there are two systems (or minds) in the one brain, has existed for as long as theories of reasoning have been explored.

It is currently thought that these two cognitive systems underlie all forms of thinking and reasoning, and that these systems have developed through evolution.[5] However, that does not mean that the two systems cannot or do not work together to reach decisions. In fact, it is becoming accepted that the expert clinician often uses them in tandem to reach effective diagnoses.[6]

The broad terms System 1 and System 2 were coined by Stanovich and West,[7] and will be used throughout this series of articles. Intuitive System 1 thinking, through the use of abductive reasoning, leads to the most plausible explanation or inference (and often ignores other explanations). Analytical System 2 thinking, especially a trained form adapted to clinical diagnosis, may use abductive or deductive reasoning to reach an explanation. In the medical and veterinary literature System 2 thinking is often referred to as hypothetico-deductive reasoning.[4] It is probably not important to fully understand the distinctions between abductive and deductive reasoning for the purposes of using Systems 1 and 2 thinking effectively for diagnosis. However, for those of you intrigued, we offer this simple explanation: *an inference (conclusion, hypothesis) from an observation that holds true in all clinical cases is a deduction; while an inference that holds true in most cases is an abduction.* Any reference to abduction or deduction in the articles will use this definition. If you are still confused, we direct you to Sun et al for further reading![8]

CASE-BASED CLINICAL REASONING IN FELINE MEDICINE

Article 1: Intuitive and analytical systems
(subtext: '*Why do I sometimes pattern recognise and at other times want to use a sequential, analytical approach to diagnosis?*')

Article 2: Managing cognitive error
(subtext: '*Why did I get the diagnosis wrong, when I thought I got it right?*')

Article 3: Use of heuristics and illness scripts
(subtext: '*Why can't I always understand how I reached the correct diagnosis – am I a genius, or was I lucky?*')

After introducing System 1 and System 2 approaches in Article 1 (which appears on pages 35–45 of this issue), we move on to discuss the cognitive errors that can accompany both systems in Article 2 (to appear in the March 2016 issue). Finally, the usefulness and pitfalls of employing heuristics (mental short cuts used in System 1 thinking and reasoning strategies used in System 2 thinking) are presented in Article 3 (to appear in the May 2016 issue). Clearly, these articles will not cover all issues affecting clinical reasoning, but hopefully the discussion of key issues will spur you on to analyse how you reason in clinical scenarios, and to read more about metacognition, the science of thinking about thinking.[9] Furthermore, we hope this will lead to an understanding of why, at times, it all goes wrong.

Clinical reasoning is central to veterinary practice. When it does all go wrong the consequences can be catastrophic (for the animal, client and/or clinician). However, we have attempted to lighten the three articles by introducing some humour, by introducing quotes from our favourite detective Sherlock Holmes and by sinking at times to 'pop psychology'. We trust this will, at least for some of you, make reading the articles fun as well as informative and memorable.

style before you will be able to detect how abnormal it can become because of cognitive errors!

We shall attempt to walk you through the process of self-discovery and bring comfort by illustrating the concepts and terms with common veterinary practice scenarios. Indeed, we will often use examples of where our own thinking was led astray by our individual (and different) thinking styles; for we are imperfect veterinarians who still adore the thrill of getting the diagnosis right!

Let that great detective, Sherlock Holmes, have the last word: '"Come, Watson, come!" he cried. "The game is afoot."'

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