GUESTEDITORIAL

Clinical Reasoning : What really Matters ?

To medical doctors	To neuroscientists
To patients	**To therapists**

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Imagine that you are a therapist. A young woman has just arrived in the waiting room of your clinic while you are treating another patient. You notice that she is wearing a splint on her left hand and holding her left arm in a protective manner. At that moment, you remember that she is under investigation for a complaint of pain in her left hand. You also remember reading in her medical record that she is twenty-three year old and had a high speed car accident in which she sustained a displaced fracture of the distal end of the radius five months ago. The fracture was treated with a cast below the elbow. Two weeks after the accident, she complained of numbness in her hand, along the ulnar border. After removing the cast, eight weeks post-injury, she still complained of pain in her hand.

Many **thoughts** would automatically cross your mind upon seeing this patient. "Why is she wearing a splint? Does she have any functional impairment? What kind of pain does she have?" In fact, even before actually questioning or assessing this woman, you would already have hypotheses that would pop into your mind about her condition. These hypotheses could be assumptions about diagnoses (e.g., impairment of the palmar or dorsal branch of the ulnar nerve), somatosensory and neuropathic symptoms (e.g., tactile hypoesthesia, throbbing, burning, radiating), or functional limitations (e.g., inability to carry out bimanual activities such as buttoning a shirt, opening a jar, etc.). If you are experienced with this kind of condition, you may probably have hypotheses of treatments and prognoses related with expected deficiencies. For instance, you would start thinking about the possibility of performing somatosensory rehabilitation and the time it would take for recovery if this woman had hypoesthesia and neuropathic pain induced by a peripheral nerve injury. Your prognosis hypothesis would be adjusted according to the patient's condition. For instance, you would expect a longer recovery period if she showed signs of complex regional pain syndrome compared to if she only complained of mild intermittent neuropathic pain. All these questions and assumptions are the starting point of clinical reasoning in an effort to identify the problem and resolve it. This also shows that clinical reasoning is central to clinical expertise because not only does it involve the diagnosis but also deals with problem management and prognosis prediction. That being said, what is the actual essence of this clinical competence?

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Clinical reasoning can be defined as thinking processes through which clinicians use their knowledge, cognition and metacognition to resolve problems in clinical practice (Higgs, 2008). A fascinating aspect of clinical reasoning is the interrelationship between its main components: knowledge, cognition and metacognition. Regarding knowledge, studies show that knowledge gained through clinical experience is essential to make sound clinical decisions. Cognition involves both intuitive and rational cognitive processes through which clinicians can generate and test hypotheses related with diagnosis and problem management. Metacognition refers to clinicians' capacity to reflect on their own thinking in order to improve it, learn from their clinical experience and improve problem management.

In the clinical example presented in the introduction, the clinician was able to generate early diagnosis as well as management and prognosis hypotheses before even starting his clinical assessment. Indeed, his clinical reasoning probably started as soon as he obtained information from the doctor's prescription and the patient's record. This ability to generate **early hypotheses** before actually assessing the patient or within the first moments of encountering the patient is described as the intuitive and non-analytical clinical reasoning system. In cognitive psychology, it is often called System 1 because it involves the first cognitive processes that take place when the clinician faces the clinical problem. System 1 involves fast, unconscious and non-analytical cognitive processes. It allows clinicians to automatically recognize important features of the clinical case and to associate them with relevant diagnosis hypotheses (Barrows & Feltovitch, 1987; Schank & Abelson, 2013). The efficiency of this system, that is its capacity to generate relevant diagnosis hypotheses when facing patient's clinical signs and symptoms, is highly dependent on the clinician's experience. The more experienced clinicians are, the more they are able to generate relevant and accurate hypotheses via System 1. More precisely, the efficiency of intuitive reasoning with System 1 seems to increase when the clinician's knowledge is well organized in his mind. As the clinician gains experience, his knowledge becomes increasingly organized and integrated so that the experienced clinician can easily link patients' symptoms with relevant knowledge stocked in memory and quickly recall relevant information. In fact, each time a clinician encounters a new case in his clinical practice, he tries to memorize all of the relevant characteristics of the new case and makes links between the new information provided by the case and his own knowledge. In this way, experienced clinicians possess highly interconnected clinical knowledge that is organized in cognitive schemas that allow them to rapidly figure out how to manage patients' problems (Schmidt et al., 1990).

One **paradox** of clinical reasoning is that although non-analytical System 1 is very effective, it is also very vulnerable to cognitive bias. Cognitive bias is systematic reasoning errors that may lead to decision-making mistakes. Numerous types of cognitive biases affecting clinical reasoning have been reported in literature. Availability and premature closure biases are among the most often cited. The availability bias is the clinician's disposition to judge things as being more likely, or occurring frequently, if they come to mind quickly. Thus, a clinician who had a recent experience with a disease is more likely to diagnose this disease (Croskerry, 2003). On the other hand, if a clinician has not experienced a condition for a long time (less available condition), he will tend to underdiagnose it. As an example, a clinician who is used to seeing patients with acute nerve impairments with pain symptoms restricted to intermittent spontaneous neuropathic pain will be less likely to detect a patient with touch-evoked pain (e.g., static mechanical allodynia). The other example of cognitive bias, premature closure, is clinicians' tendency to close the decision-making process precariously, and accept a diagnosis before it has been fully verified (Croskerry, 2003). As an example, if at first sight a clinician thinks that the pain is musculoskeletal, he will then have difficulty seeing and taking into account other signs suggesting that the pain may be neuropathic.

Fortunately, there is another system of cognitive processes involved in clinical reasoning that complements System 1 and thus minimizes the effects of cognitive biases. In cognitive psychology, this other system - **analytical reasoning** - is often designated as System 2 because it plays a security role by cross-checking the hypotheses generated by System 1. In contrast to System 1, System 2 involves conscious, slow, and deliberate analytical cognitive processes. It is also referred to as hypothetico-deductive reasoning. Thus, if the clinician starts thinking of the following hypotheses intuitively (System 1) : "this patient seems to have a spontaneous intermittent neuropathic pain resulting from an impairment of the ulnar nerve", this clinician may then start using analytical reasoning (System 2) and think as follows: "I should use appropriate evaluations to check whether the patient may also have touch-evoked pain or even signs of complex regional pain syndrome". This complementarity of non-analytical and analytical cognitive processes for achieving efficient clinical reasoning is described as the dual process theory. This theory stipulates that proficient clinicians are fluent in using this judicious combination of unconscious and conscious cognitive processes to potentiate their clinical reasoning (Marcum, 2012); however, novice clinicians may lack the clinical experience to navigate through these processes effectively and achieve correct and efficient clinical reasoning. Clinical reasoning algorithms have been developed to help clinicians formulate their diagnosis hypotheses and select relevant evaluations to test these hypotheses. In this context, a clinical algorithm is a flowchart that is specifically designed to represent a series of clinical decisions to guide the patient's assessment and care (Margolis, 1983). Such algorithms, used to support clinical reasoning pertaining to the assessment and treatment of patients with somatosensory symptoms from nerve impairments, have been developed by Spicher et al. (2015, 2016). These algorithms are meant to improve the assessment and management of patients by supporting clinicians' decision-making processes.

This raises the question of what clinicians can do **to improve their clinical reasoning** ? This question is certainly a legitimate one given the challenge of incorporating multiple contemporary approaches to their clinical practice such as the evidence-based practice, patient-oriented approach and international classification of diseases and related problems. One should also note that this question bears the assumption that clinical reasoning can be fostered and learned and that it involves more than just innate ability. As previously mentioned, the wealth of clinical experience is determinant for the efficiency of automatic cognitive processes involved in clinical reasoning; however, it seems that gaining clinical experience is not sufficient to improve clinical reasoning skills and to eventually become an expert in a clinical practice field. Indeed, not all clinicians become experts in their field as they gain experience. To improve their clinical reasoning skills, clinicians must be deeply committed to their clinical practice, and practice in specific ways that foster expertise. Three types of clinical practice contributing to the improvement of clinical reasoning skills must be considered: specific, reflective and deliberate practice.

Specific practice refers to the evidence showing that **clinical reasoning skills** are domain specific. This means that if a clinician is experienced and developed his clinical reasoning in, for instance, managing patients with musculoskeletal and orthopaedic conditions, he will not be as skilled in the management of patients with neurological conditions. In fact, as clinicians, we become expert in the very specific clinical domain and context in which we are used to practicing. Another example would be that a clinician may be an expert in acute care but not in the rehabilitation of somatosensory troubles in patients with nerve impairments. Thus, clinicians must be aware of the limitations of their expertise and recognize when the clinical condition is beyond the scope of their usual practice. When clinicians want to improve their skills beyond that scope, they should engage in reflective and deliberate practice.

Schön (1983) was the first to theorize the idea of **reflective practice**, which consists in thinking about and critically analyzing one's actions in order to improve one's professional practice. In a clinical perspective, reflective practice employs a clinician's ability to be aware, to give meaning and to learn from his own clinical experience in order to make his clinical practice more efficient and satisfying. A simple way to use reflective practice would be to deliberately reflect on one's thinking when facing a difficult case. For instance, when a case is beyond our usual scope of practice, one can reflect on the plausibility of the first diagnosis hypothesis that popped in our mind, and on whether one can deliberately infer new hypotheses.

Deliberate practice provides an integrated approach for improving clinical reasoning skills and expertise in clinical practice. Deliberate practice involves assiduous and targeted practice of targeted tasks and the evaluation of the performance on these tasks through self-assessment and an external resource to improve it (Ericsson, 2007). For instance, a clinician can engage in deliberate practice by starting to assess more patients with conditions that he is not used to managing and asking a colleague for guidance and feedback. Some educational methods, such as SNAPPS and the one-minute preceptor (Pascoe et al., 2015), fit well with deliberate practice because they were designed to help provide proper guidance and feedback to learners or colleagues in clinical settings.

In summary, clinical reasoning is the **cornerstone of expertise** in health professions. It involves proper balance between unconscious and conscious cognitive processes. As clinicians gain experience, their knowledge becomes better organized to meet the needs of patient assessment and management. The somatosensory rehabilitation method provides algorithms that support clinical reasoning in the management of somatosensory troubles in patients with nerve impairments. The design of these algorithms, which highlight potential diagnosis hypotheses and treatment options, is consistent with current theories on clinical reasoning. The somatosensory rehabilitation method provides a relevant framework for helping clinicians to engage in reflective and deliberate practice expertise in this specific field of clinical practice.

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