

## Clinical Reasoning and Sports Medicine-Application of Hypothetico-Deductive Model

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### Abstract

Hypothetico-deductive model of clinical reasoning was proposed by Mark Jones and it involves the self-reflection and informed clinical decision making process of generating and testing hypotheses in association with the patient's presenting symptoms and signs. Sports medicine is a dynamic field with an ever-changing wealth of evidence-based information from practice, education and research. The objective of this editorial is to illustrate the application of clinical reasoning in sports medicine explained via the hypothetico-deductive model for a 23-year old female basketball player who presents with unilateral ankle pain after a twisting injury while landing on the foot. The eight hypotheses categories of dysfunction, pathobiological mechanism, and source of symptoms, contributing factors, precautions, management, prognosis and mechanisms of pain were described to illustrate the case example with emphasis on hypotheses generation and testing as an ongoing process in reflective thinking and individualized decision making in sports medicine.

**Keywords:** Clinical reasoning; Reflective thinking; Critical thinking; Decision making

### Introduction

Hypothetico-deductive model of clinical reasoning was proposed by Mark Jones and it involves the self-reflection and informed clinical decision making process of generating and testing hypotheses in association with the patient's presenting symptoms and signs [1]. Clinical reasoning though 'clinical', is not dependent upon the setting per se, and is evidently more influenced by the clinician's own cognitive and perceptual processes of knowledge, cognition and meta-cognition as its determinants [2].

Sports medicine is a dynamic field with an everchanging wealth of evidence-based information from practice, education and research [3]. Clinical reasoning was described for individualized patient evaluation and management in clinical problem solving for "difficult-to-treat" situations in routine practice [4,5]. The objective of this editorial is to illustrate the application of clinical reasoning in sports medicine explained via the hypothetico-deductive model for a 23-year old female basketball player who presents with unilateral ankle pain after a twisting injury while landing on the foot.

### Dysfunction

- General dysfunction-athletes are often concerned about their injury if it impairs their game performance. e.g., Difficulty to jump, walk or stair climbing.
- Specific dysfunction-localized structural and functional alterations which are associated with a particular general dysfunction. e.g. Plantarflexor tightness, hypermobile ankle, sprained anterior talofibular ligament.
- Cognitive/affective dysfunction-Psychosocial influences and maladaptive understanding and associated emotions play a large role in symptom perception and reporting. e.g., Fear of career loss, anxiety about problem and its future impact on performance.

### Pathobiological mechanism

- Input-Specific mechanical/chemical/thermal stimuli which

provoke symptoms would be considered as input. e.g. Weight-bearing on the affected side ankle is painful.

- Central processing-Body's inherent homeostatic mechanisms that operate to mediate a stimulus-response interaction are considered here. e.g. Chronic or recurrent functional instability due to altered central neuromuscular control.
- Output- Somatic structural and functional alterations that manifest as symptoms and signs are considered as output. e.g. Reduced and painful ankle dorsiflexion range of motion.

### Source of symptoms

- Somatic (local/referred)-All related structures should be pathomechanically associated with the presenting dysfunctions and pathobiological mechanisms.
- Visceral (local/referred)-All relevant visceral structures which can refer symptoms at the site under consideration should be screened by clearing questions. Identification of red flags and comorbid systemic disorders is possible through this process. e.g., Vascular injury to lateral peroneal vessels might lead to ecchymosis.

### Contributing factors

- Physical-Other associated structural alterations like strength and flexibility, joint mobility, proprioception which maintains the dysfunction and causes persistence of symptoms rather than symptoms per se. e.g., tight heel cord causing excessive

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plantarflexion moment at ankle thus leading to recurrence of sprain.

- Environmental/ergonomic-Factors from outside the body such as room temperature, play surface, type of shoe, etc., are to be considered so. e.g. A sports shoe without a high heel counter would promote ankle instability.
- Cognitive/affective-Athlete's knowledge, attitudes, beliefs and past experiences would influence the present understanding and co-operation during therapy and is also the main factor that determines adherence to exercise prescription. The emotional (affective component) experience and expression associated with the symptoms would again determine recurrence or persistence. e.g. A belief that "no pain, no gain" would encourage overuse and 'pain provocateur' coping style among injured athletes [6].

### Precautions and contra-indications

- Yellow flags-Indicators for undertaking precautions and limiting further physical examination such as severity, irritability, nature, stability, 24 hour behavior, and disability compensation claims etc., should be identified and appropriately documented both for client safety as well as for medicolegal purposes.
- Red flags-Both systematic and local contraindications such as infections, malignancies, medically diagnosed systemic disorders whose manifestations co-occur with present symptoms should alarm the sports medicine physician of serious pathologies that might require detailed diagnostic workup and early appropriate referral. e.g. Unexplained weight loss in the previous week or evidence of avulsion fracture of lateral malleolus.

### Management

Use of simple clinical decision making algorithms could be used for deciding the plan of management.

- Referral (no therapeutic examination)-Indicated in presence of red flags.
- Hands-off (partial therapeutic examination and treatment advice)-Indicated in presence of yellow flags.
- Hands-on (full therapeutic examination and prescription)-Indicated in suitable cases.

### Prognosis

- Positive indicators-young age, male gender, specific pathology, mechanical dysfunctions, absence of comorbid disease conditions, absence of yellow and red flags, input-predominant processing, absence of cognitive-affective mechanism, and lesser contributing factors may favor positive therapy outcomes.
- Negative indicators-old age, female gender, atypical pathology, inflammatory dysfunctions, serious comorbid disease conditions, presence of yellow and red flags, predominant central processing and output mechanisms, presence of cognitive-affective mechanism, and too many contributing factors may delay the therapy outcomes.

### Mechanisms of pain

Mechanism-based classification of pain as described by Kumar and Saha [6] is one of the most useful method of conceptualization and

categorization of presenting symptoms and signs in order to facilitate therapy decisions.

- Cognitive-affective-psychosocial influences and manifestations due to pain especially in chronic pain states are common such as depression, anxiety, illness behavior, fear-avoidance, catastrophizing and maladaptive understanding associated with the problem or its management. Cognitive-behavioral therapies would address this mechanism.
- Central sensitization-usually presents with more severe tissue damage, where the symptom experience is "centrally summated" with past experiences, to produce a heightened state of pain perception that involves cortical representation of pain and a pain neuromatrix. Clinically, it is identified by non-anatomic distribution of symptoms and diffuse tenderness along the rest of the body parts. Therapy focusing on intensive pain neurophysiologic education would address central sensitization.
- Sympathetically maintained pain-presenting autonomic dysfunction which is mechanically provoked, and aggravated by stress and relieved by relaxation techniques.
- Peripheral sensitization-neurodynamic dysfunctions that manifest as abnormal mechanically induced neuritic pain, found on neurodynamic testing of common peroneal nerve or mechanical allodynia on manual palpation of the nerve at fibular neck may suggest this mechanism, which is treated using neurodynamic techniques such as nerve sliders and nerve massage.
- Nociceptive-other musculoskeletal innervated tissues such as lateral ligament, capsule, and related peroneal tendons could produce symptoms due to mechanical stress like stretch, compression, torsion and injury which are treated using 'P-R-I-C-E' methods in sports injury rehabilitation in acute settings.

### Conclusion

Application of multifaceted knowledge into clinical reasoning strategies was termed as dialectic reasoning which was suggested for use in both novice and expert professionals [7]. Clinical reasoning was shown to be successfully applied along International classification of functioning, disability and health (ICF) framework for standardized yet individualized patient management [8].

Although time consuming in the beginning for a novice sports medicine practitioner, HD model facilitates critical reflective thinking and enables pattern recognition among experts as well as students [9]. Such elaborate and in-depth reasoning process would not only ensure therapeutic safety but also improve sports medicine clinician's professional knowledge and skills.

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