Musculoskeletal Pain- Moving from Symptoms and Syndromes to Mechanisms

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Introduction:

Pain is defined by International Association for the Study of Pain as; “An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.” Pain is often considered the fifth vital sign, but often misinterpreted since it is considered mainly subjective. Pain relief is a major goal for health care in India so much that most therapeutic interventions necessarily begin first with pain relief.

Physical therapists play an important role in pain management ranging from symptom control to improving quality of life and they are regarded as highly proficient members of multidisciplinary healthcare team towards management of chronic pain. The effects of physical therapy in pain management extend far beyond physical into the behavioral domain of care.

Pain necessarily involves three different levels of classification- based upon pain symptoms, pain mechanisms and pain syndromes. It is well understood that multiple symptoms can be caused by a single mechanism whilst multiple mechanisms operate to produce a single symptom.

Classification of pain- the historical perspective:

Anatomical classification of pain:

This is a common step towards classifying pain. Patients often report pain or other symptoms localized to an anatomical region (neck pain, arm pain, leg pain etc). Other subjective pain descriptors such as ‘superficial and deep’, and ‘localized and diffuse’ are also anatomical in...
origin. The physical therapist who performs a thorough subjective examination can differentially diagnose painful symptoms as originating from structure(s) of involvement (muscle pain, joint pain, nerve pain, abdominal pain etc). The origin of anatomical classification of pain lays in the tradition that classification of pain originally into somatic (musculoskeletal or external organs) and visceral (internal organs) that were anatomical in origin. The anatomical source of pain is promptly identified by anesthesiologists and interventional pain physicians. Diagnostic blocks using local anesthetics are considered as 'gold standard' in diagnosing anatomical source of pain. Management of pain based on anatomical origin usually involves surgeries performed to repair and restore structural properties of the affected tissues.

**Physiological classification of pain:**

Understanding of pain physiology and mechanisms led to the broad physiological classification of pain into central and peripheral pain. The peripheral pain can be from neurogenic or non-neurogenic origin. The central pain was always neurogenic and it involved dynamic neuroplasticity of central nervous system pathways and cortical representation of pain in the somatosensory area. The peripheral neurogenic pain arises from the nerve nervorum that innervated the peripheral nerve trunks leading to nerve trunk pain or dysesthetic pain. The nerve trunk pain is stimulus-evoked (can be mechanical, chemical or thermal stimulus) and dysesthetic pain is spontaneous pain.

**Pathological classification of pain:**

Oaklander\(^{13}\) listed under nosology of pain the two types- acute and chronic. The author explained acute pain as an adaptive beneficial response occurring for preservation of tissue integrity. It is often associated with flexion-withdrawal response. Chronic pain was further classified into nociceptive and neuropathic. Continuing tissue damage lead to nociceptive pain, where continuous peripheral sensory system stimulation lead to changes in signal processing within the dorsal horn of the spinal cord termed as ‘central sensitization’ that potentiated the ‘central pain’ state. In neuropathic pain, the sensory nervous system itself got injured and continued to transmit pain signals despite the absence of injury or after the actual healing of injury occurred. The author termed neuropathic pain as pathologic pain since it was not from its original area of involvement.

**Pathophysiological classification of pain:**

The pathophysiological processes leading onto pain stimulation and perception influenced pain classification into mechanical and inflammatory pain.\(^{14}\)

As we notice further, the above-mentioned classifications and descriptions have a phenomenal overlap between them, which in a multidisciplinary palliative care scenario, would eventually lead onto clinical miscommunication and misinterpretation between various healthcare professionals. Expert clinicians and researchers on pain evaluation and management suggested a process of clinical reasoning to understand the multidimensional feature of pain by relating it with the biopsychosocial model.

**Clinical classification of pain:**

Clinically pain was classified based on duration since onset- into acute, sub-acute and chronic pain. Also, based on intensity, pain can be classified into mild, moderate and severe. For instance, the IASP classified pain broadly into nociceptive and neuropathic pain. Neuropathic pain was further classified into central and peripheral neuropathic pain which were described to arise from disease or dysfunction of central or peripheral nervous system respectively. Presence of upper motor neurone or lower motor neurone symptoms and signs indicate central or peripheral nervous system dysfunction associated with pain which can be detected by a detailed or even by a screening neurological examination. The nociceptive pain could then be classified anatomically as mentioned earlier.
Diagnostic classification of pain- pain syndromes:

Diagnostic terms related to pain are often used by medical professionals in management of pain such as anesthesiologists, pain physicians, physiatrists, oncologists, gerontologists and neurologists/neurosurgeons. Diagnostic pain classification utilized the associated clinical symptoms and signs towards classifying pain such as; phantom limb pain, diabetic peripheral neuropathic pain; chemotherapy-induced pain; cancer pain etc.

Classification of pain- influence of clinical reasoning:

Clinical reasoning-based classification of pain and interpretation of causes and associated symptoms in patients with pain included seven hypotheses categories; dysfunction, pathobiological mechanism, source of symptoms, contributing factors, precautions and contra-indications, management, and prognosis.  

Classification of pain- influence of mechanisms into practice:

The first ever mechanism-based theory for pain and nociception was the ‘gate-control’ theory by Melzack and Wall which was a breakthrough in pain sciences in that era. The theory emphasized on the central and peripheral mechanisms for nociception and antinociception. They also detailed the role of lamina-2 of dorsal horn of spinal cord (substantia gelatinosa) to play the role of “gate” in controlling the path for pain impulse transmission. The nociceptive impulses are carried by afferent fibers (thin diameter nerve fibers) to the higher centers (somatosensory cortex) where the perception of pain occurs. The other stimuli such as electrical, mechanical or proprioceptive impulses are carried by thick diameter fibers which when transmitting across the gate, tend to “close” the gate for pain impulse transmission thus leading to the pain relief at spinal cord level. The theory was further expanded and revised by Wall. The gate-control theory of pain was historically the first to explain pain depending upon its mechanisms.

Evolution of mechanism-based classification of pain:

Over the years of pain management practice, physiological or mechanism-based classification of pain evolved and grew as follows; Devor outlined central and peripheral pain mechanisms both neuropathic and nociceptive, for reception, transmission, perception and response to a painful stimulus. Woolf et al proposed the mechanism-based classification of pain and this approach is likely to lead to specific pharmacological, surgical or physical therapy interventions for each identified mechanism involved in a particular pain syndrome. This approach had classified pain into three broad categories with explanation of possible mechanisms under each category; transient nociceptive; (2) tissue injury pain-primary afferent (sensitization, recruitment of silent nociceptors, alteration in phenotype and hyperinnervation) and CNS-mediated (central sensitization recruitment, summation and amplification); and (3) nervous system injury pain- primary afferent (acquisition of spontaneous and stimulus-evoked activity by nociceptor axons and somata at loci other than peripheral terminals, phenotype change) and CNS mediated (central sensitization, deafferentation of 2nd order neurons, disinhibition, structural reorganization).

Though originally proposed by Woolf, it was Gifford and Butler who took a giant leap forward to integrate pain sciences into physical therapy practice by detailing about central and peripheral mechanisms of pain. Much later, studies on physical therapists by Smart and Doody who were experts in clinical reasoning of pain indicated that there were five operating mechanisms in pain perception. They were:

- Central sensitization/central neurogenic mechanism
- Peripheral sensitization/peripheral neurogenic mechanism
- Peripheral nociceptive mechanism
- Sympathetically maintained pain/sympathetically dependent pain mechanism
• Cognitive-affective (psychosocial) mechanism

One of the mainstays in non-pharmacological interventions in pain and palliative care is physical therapy. Jones et al described the importance and process of integrating a biopsychosocial model into clinical practice of physical therapy and rightly though, the highest level of evidence-the Cochrane collaboration systematic reviews and/or meta-analyses support multidisciplinary biopsychosocial interventions for ‘very difficult to manage’ pain conditions such as fibromyalgia, work-related neck and shoulder pain, and work-related sub-acute low back pain. Biopsychosocial correlates for chronic pain severity was shown by Penny et al but the mechanism-based classification is definitely not against the biopsychosocial model though it appears often on a first look. It is imperative that biological mechanisms are central sensitization, peripheral neurogenic and nociceptive; psychological mechanisms are central sensitization and cognitive-affective; and, social mechanism is mainly cognitive-affective. Such a biopsychosocial understanding of mechanism-based classification of pain is essential for successful management of pain in physical therapy practice. Physical therapists need to expand their knowledge base by often ‘thinking out of the box’ to implement a comprehensive rehabilitation program rather than a technique-oriented therapeutic program for their patients with pain. There were epidemiological studies on MBC reported on patients with MSK pain and effectiveness of MBC-based treatments was also shown recently amongst patients with complex regional pain syndrome type-1. Further studies on education of mechanism-based classification and such classification-based treatments in clinical practice are essential before extrapolating the evidence into physical therapy evaluation and management of patients.

Implications and role of Journal of Physical Therapy (JPT):

JPT welcomes manuscripts which aim to explore a further deeper insight and understanding into pain sciences especially mechanisms underlying pain and other related symptoms. Authors are encouraged to submit their basic science papers (both original and review articles) on mechanisms and pain sciences with appropriation of provided information into physical therapy practice, education and research so that publication of such papers would facilitate further shift in bettering the evidence-informed paradigm.

Readers are welcome to read the excellent review by Ahuja in our previous issue, where the author explored an insight into mechanisms behind lateral epicondylalgia and mobilization with movement (MWM) techniques, thus furthering integrated research combining both clinical and basic science aspects of the disorder.

The MBC movement not only occurred significantly in pain per se, but in cancer pain too.

References:


Musculoskeletal pain- symptoms, syndromes & mechanisms

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Editorial


