

Pain and Hand Function



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KEYWORDS

• Pain • Acute pain • Chronic pain • Neuropathic pain • Hand function

KEY POINTS

- Pain is a unique somatosensory perception that can dramatically affect our ability to function.
- Pain is a necessary perception, without which we would do irreparable damage to ourselves, dramatically affecting the ability to function.
- Pain can be categorized into acute pain, chronic pain, and neuropathic pain.
- Hand function and objective measurements of hand function are analyzed as well as the impact of different types of pain on each of these areas.

INTRODUCTION

Pain is the unpleasant perception associated with actual or potential cellular damage. However, pain does not always have to be a "...useless, unjust, incomprehensible, inept abomination..." as described by J.K. Huysmans.¹ Robert Sapolsky wrote:

*Pain is useful to the extent that it motivates us to modify our behaviors in order to reduce whatever insult is causing the pain, because invariably that insult is damaging our tissues. Pain is useless and debilitating, however, when it is telling us that there is something dreadfully wrong that we can do nothing about. We must praise the fact that we have evolved a physiologic system that lets us know when our stomachs are empty. Yet at the same time we must deeply rue our evolving physiologic system that can wrack a terminal cancer patient with unrelenting pain.*²

Pain can uniquely affect the function of the hand in a variety of ways, dependent on the type, quality, and severity of the pain. How many patients with a painful affliction of the hand have thought, *if only I didn't have this pain, I would be able to...*? And yet, one of the more intriguing aspects of pain is that without it, the impact to the hand

would be just as devastating as those resulting from severe, intense pain. The necessity of pain has been thoroughly illustrated by Paul Brand, in his lifelong work with patients afflicted by leprosy. Leprosy, or Hansen disease, is caused by *Mycobacterium leprae* and can affect the peripheral nerves in patients' bodies, leading to paralysis and loss of sensation, including pain. In Brand and Yancey's book, *The Gift of Pain*, they describe their initial troubles in the postoperative care of patients with leprosy:

*Most physiotherapists in hand surgery have to coax their recuperating patients to move their fingers a little more each day...In working with leprosy patients, we fought the opposite problem of preventing them from moving their fingers too much too soon...the same hand therapist treating two identical tendon transfer recipients, one due to polio and the other to leprosy, would urge one on to greater effort, and strive to hold the other one back. Several times I had to repair tendons that had been yanked out by an overeager leprosy patient.*¹

Hand function can be significantly affected by any pain or no pain at all; thus, assessment is even more difficult. The authors describe different types of pain, which can be generally categorized

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as acute, chronic, and neuropathic. Using specific examples of these types of pain, the authors assess how each can distinctively affect the function of the hand. The authors then describe basic hand functionality, measurements of hand function, and the complex role that pain plays in hand function.

PAIN

The mechanism of pain from stimulus to perception can be generalized into 3 stages. In the first stage of pain, the *pain signal* is the activation of pain receptors to real or perceived danger. At the second stage, the *pain message* is relayed through the central nervous system (CNS) from the spinal cord to the brain. This stage is where the gate theory of pain comes into play. The last stage is the *pain response*. After the message is relayed to higher cortical centers in the brain, a decision is made based on all incoming messages and current priorities about how to respond to the initial signal that was triggered. Pain, as a real perception, does not actually exist until all 3 stages have been complete.¹ Although an overly generalized description of the pain pathway, it holds true as a sound basis of understanding. Many painful diseases can be understood in terms of these 3 stages.

ACUTE PAIN

Acute pain is a physiologic response to impending or recent danger.³ Often appearing suddenly, it is described as sharp or throbbing and may range from mild to severe. Acute pain is an essential component of the hand examination as it often helps localize and identify the causes of injury. Reproducing acute hand pain is often easy to do by observing the position of the hand, directly palpating, or performing provocative tests.

Nociception, the physiologic process of acute hand pain, involves 4 complex processes.⁴ It is the rapid progression and synchronization of these processes that warn patients of injury. These processes are vital to the preservation of hand function because these serve as both alarming and protective measures.

The 4 processes of nociception include transduction, transmission, perception, and modulation.⁴

Transduction

The first process is the *pain signal*. There are free nerve endings known as nociceptors present in somatic structures, such as skin, muscles, connective tissue, bones, and joints. These nociceptors

respond to noxious stimuli, such as recent surgery; infection; bony trauma, such as fractures or dislocations; soft tissue injury, such as burns or lacerations; tendon injury; or ischemia, such as compartment syndrome. Nociceptors present on the C and A pain fibers of neurons are associated with different qualities of pain. The A fibers are larger and myelinated, making them fast conducting and primarily responsible for well-localized, sharp pain seen in acute hand pain.⁴⁻⁶

Transmission

The second stage is the *pain message*. The process begins with transmission from the nociceptors to the spinal cord and to the brain stem and thalamus.⁴⁻⁶

Perception

The third stage of pain is the *pain response*. From the brain stem and thalamus, signals are sent to cortices resulting in the perception of pain as a conscious experience. Multiple systems are activated, each accounting for different responses. For example, the reticular system results in the autonomic and motor response to pain. The somatosensory cortex interprets the intensity, quality, and location of the pain and relates it to past experiences. The limbic system is responsible for the emotional response to the pain.⁴

Modulation

After perception, pain impulses are then transmitted back through the spinal cord resulting in either increased (excitatory) or (inhibitive) impulses. Analgesia is produced by these inhibitive impulses that release opioids. This process is known as endogenous pain modulation and explains the different perceptions of pain among patients.⁴⁻⁶

CHRONIC PAIN

Chronic pain is pain lasting more than 3 month that begins as acute pain that fails to resolve. Although in many cases there is an accountable inciting event, in some there is never any known cause. Its longer presence affects patients' ability to use the hand and perform basic activities of daily living (ADL). Examining these patients is often difficult as they are apprehensive to any provocative test, palpation, or motion that may trigger an increase in pain. This pain often becomes more constant and generalized while losing the sudden, sharp, localized qualities associated with acute pain.

In contrast to acute pain, the exact physiology of chronic pain remains unclear. It is thought that

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