Beyond the Self-Reports: A Review on Objective Pain Measurement and Its Implications

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Abstract

Current methods of pain measurement are inadequate in capturing the complexity of the pain experience. This limitation arises mainly because these methods tend to overlook the multiple dimensions of pain during assessment, heavily relying on self-reported measures, which inherently have their drawbacks. Self-reported measures aim to gauge the pain severity experienced by an individual, based solely on their perception of the most intense pain sensation. However, these measures are prone to various biases and may not accurately reflect the actual pain experienced.

To overcome these limitations, a new system of pain assessment is necessary, which minimizes subjective involvement and provides a more accurate representation of pain. The 'Pain Calculator' is a newly developed tool that has demonstrated promising accuracy in measuring somatic pain in the low back region. This tool effectively overcomes the subjective biases characteristic of the self-reported measures and provides a reliable and clinically feasible alternative to the existing pain assessment tools.

Keywords: Pain Measurement, Pain Assessment, Nociception Tests, Analogue Pain scale, Pain Severity, Pain Threshold.

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Introduction

Pain is the most common symptom encountered by clinicians in their daily practice. Despite its prevalence, accurately measuring pain has remained a challenge for both clinicians and researchers. Traditionally, pain has been assessed based on its intensity using self-reported tools such as the Numeric Rating Scale (NRS), Visual Analogue Scale (VAS), and Verbal Rating Scale (VRS).[1,2] However, relying solely on pain intensity fails to capture the multidimensional nature of pain and oversimplifies it as a unidimensional experience. As highlighted by the International Association for the Study of Pain (IASP), pain is "An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage".[3]

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Shortcomings of the conventional pain assessment:

As previously mentioned, pain is a multidimensional experience that involves sensory, emotional, and cognitive dimensions.[1,2] Thus, to accurately assess pain, all these dimensions should be considered. While pain intensity represents the sensory-discriminative dimension of pain, the motivational-affective dimension pertains to the unpleasantness and emotional aspect of the experience.[1] Although these two constructs may appear similar, they are distinct concepts, and their measured values do not necessarily correlate in an individual. This means that the pain experience may not be equally unpleasant in two individuals having similar self-reported intensities. This was further highlighted in a recent diagnostic study, where most participants reported different levels of pain intensity and pain affect for their low back pain. Paradoxically, some participants reported very little unpleasantness associated with substantially intense pain.[4]

Assessing the affective aspect of pain is crucial because the areas of the brain responsible for pain perception largely comprise the regions that also subserve emotional and motivational responses, such as the limbic system and primitive brain regions.[1, 5] Therefore, it is essential to include the affective aspect of pain in pain assessment. To accomplish this, an adaptation of VAS has been proposed in the literature, involving replacing the standard anchors of 'no pain sensation' and 'the most intense pain sensation imaginable' with 'Not bad at all' and 'the most unpleasant feeling possible for me' on each end of the scale.[6]

Of all the self-reported scales, VAS is unique because it assumes a true zero and has ratio-scale properties.[6] However, despite having good psychometric properties, VAS is prone to subjective biases because it is a self-reported tool.[2] This not only affects the accurate depiction of pain but also makes it difficult to make valid

comparisons between the pain scores of different individuals. This problem is inherent in the design of these self-reported scales, which rely on the patient's own perception of the most intense pain imaginable. This concept has a different meaning for each person as every individual is exposed to a different level of pain. As a result, such scales yield a score that is relative to a self-perceived criterion/standard that itself varies. This can also cause recall bias as individuals are required to retrospectively compare their current pain level with more intense pain experienced previously. This results in a pain measurement that does not adhere to the fundamental assumption of interval equality, rendering comparisons between individuals invalid. Thus, to achieve the objective measurement of pain, several methods have been proposed, such as fMRI, PET, EEG, MEG, etc.[2,7] However, the objectivity these approaches offer is limited to 'nociception' only and fails to encompass the actual pain experience. These two terms are often confused as being synonymous, when in fact, they represent different phenomena. While pain represents an entire sensory, emotional, and evaluative experience, nociception refers to the neuronal activity underlying that experience.[3]

The Way Forward:

Because pain is a personal experience, accurately measuring it requires some involvement from the individual. Therefore, the solution to this paradox lies not in complete elimination, but rather in minimization of the subjective involvement in recording pain. This can be achieved through indirect measurement of pain using a quantifiable variable that has an established relationship with pain. One such alternative is the pressure pain threshold (PPT), a measure of pain sensitivity that is both measurable and has a proven inverse relationship with pain. PPT allows limiting the subjective response to a simple 'yes', while inflicting less discomfort on the patient.[8] However, PPT alone cannot serve as an independent surrogate measure of pain due to a multitude of factors influencing the experience of pain. For instance, a cross-sectional study conducted by Marta Imamura showed that PPT alone explained only 11% of the pain intensity in patients with chronic nonspecific low back pain.[9]

To address these biases, we developed a unique solution for objectively measuring somatic pain in the low back region. Our study, entitled 'Development of a tool for objectively measuring somatic pain in the low back region based on a longitudinal diagnostic study conducted in Karachi, Pakistan,' proposed the use of a 'Pain Calculator.'[4] This calculator operates on predictive models and probability equations that take into account variables having independent relationships with pain to yield an objective pain score. The pain score it yields is of sufficient statistical accuracy to predict the levels of pain intensity, pain affect, and the resultant disability.[4] While it does not yet provide insights regarding the quality of the pain, it offers the opportunity to compare gradations of pain among individuals, much like comparing values of blood pressure, weight, and temperature. The Pain Calculator was initially designed for the low back region, however, its utility can be expanded to other regions of the body in the future. For the first time, it allows us to definitively state that a person with a certain level of pain is indeed suffering from more pain than another individual, a milestone that was previously considered unachievable.

Conclusion:

The implications of objective pain measurement are significant, as introducing objectivity into the assessment of the subjective experience of pain can help researchers and clinicians more effectively evaluate the efficacy of treatment or the progression of a condition. It eliminates the need for individuals to retrospectively compare their pain, reducing recall bias and preventing over and underreporting of pain. Additionally, it enables pain to be included as an essential component of triaging, making the process more rigorous, impartial, and pain-focused. Furthermore, it shifts treatment guidelines toward being more pain-centric, leading to improved healthcare delivery and effective policy-making. The objective measurement of pain represents a new era in which pain can be represented in its true numerical value, resulting in better healthcare outcomes for patients.

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Disclaimer: It is important to note that this narrative review does not intend to provide an exhaustive guide to cover all pain assessment tools currently in use. Interested readers are encouraged to refer to the available literature for a more comprehensive understanding of pain assessment tools.

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