A Biopsychosocial Approach in Chronic Pain: A Brief Review

Ioannis Koukoulithras[1], Spyridon Kolokotsios[2*], Minas Plexousakis[2] and Alexandra Stamouli[2]

[1]Department of Orthopaedic Surgery, University of Ioannina, Greece, Athens, GRC

[2]Department of Physical Therapy, University Hospital, University of West Attica, Greece, Athens, GRC

*__Corresponding author:__ Spyridon Kolokotsios, Department of Physical Therapy, University Hospital, University of West Attica, Greece, Athens, GRC, E-mail: espy70@gmail.com

Abstract

Chronic pain is a leading cause of disability worldwide and is the most common reason people seek medical attention. Many factors contribute to the perpetuation of pain, such as biological, psychological, and social factors. The Biopsychosocial model, which is an interaction of these factors, can exacerbate patients' clinical appearance and outcomes with chronic pain. To regain function and increase the quality of life and wellbeing, people with chronic pain require a holistic approach that combines basic clinical care with biopsychosocial model management. Physicians' education in pain and the collaboration between experts of multiple fields is also vital in order to treat patients in a more effective way.

Keywords: Biopsychosocial model; Chronic pain; Pain management; Sick role

Introduction

Non-malignant pain is a significant cause of disability worldwide and is the most common reason people seek medical attention. The current cost of chronic pain in Europe is estimated to be more than 200 billion euro per annum. Consequently, a great deal of research and clinical trials on that topic have been fuelled in order to lower the costs. However, despite the enormous costs associated with patient management and research, chronic pain remains under-recognized and ineffectively managed [1]. The International Association for the Study of Pain (IASP) defines pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage" [2].

The biopsychosocial model, which presents the interaction of biological, psychological, and social factors, appears to worsen the clinical presentation of patients suffering from various types of pain. Therefore, it is critical to focus on modifiable biopsychosocial factors while remaining mindful of non-modifiable aspects. Furthermore, knowledge of these factors is essential to improve patients' quality of life and regain their function, such as attitude, neuroticism, and trait anxiety, known

to be stable over time [3]. Thus, a biopsychosocial-model-based approach has been the most heuristic perspective for understanding and treating chronic pain.

Literature Review

Correlation between biopsychosocial model and pain

George Engel and John Romano proposed the biopsychosocial model for the first time in 1977 in contradiction to the traditional biomedical reductionist philosophy that dominated the field of medicine since the Renaissance. This model reflects illness development through the complex interaction of biological, psychological, and social factors. Pain is considered to be the subjective perception of the results of the transduction, transmission, and modulation of sensory information. It presumes damage to musculoskeletal tissues and nerves that initiate nociceptive input to the brain [1]. Appraisal of this input involves personal experiences attributed to the pain, such as prior learning history, current psychological status, and sociocultural influences and thus influences and consequent behaviours. These appraisals are further influenced by the beliefs each person has acquired over their life. So, a person can either ignore the pain and continue to work, as well as be physically and socially active, or they can retreat from these activities and have a "sick role" [1].

Also, beliefs about pain are formed by close family and friend's responses that may promote either a healthy, active response or sick role. **Figure 1** presents the interactions between biological, psychological, and social factors, which in combination influence the prevalence, maintenance, and management of pain. There is strong evidence supporting pain management's efficacy based on the biopsychosocial approach [4]. Therefore, to improve patients' quality of life and regain their function, a biopsychosocial approach is required. Moreover, physicians should not ignore the importance of these factors (biological, physiological, social, and economic) to treat these patients' various issues.
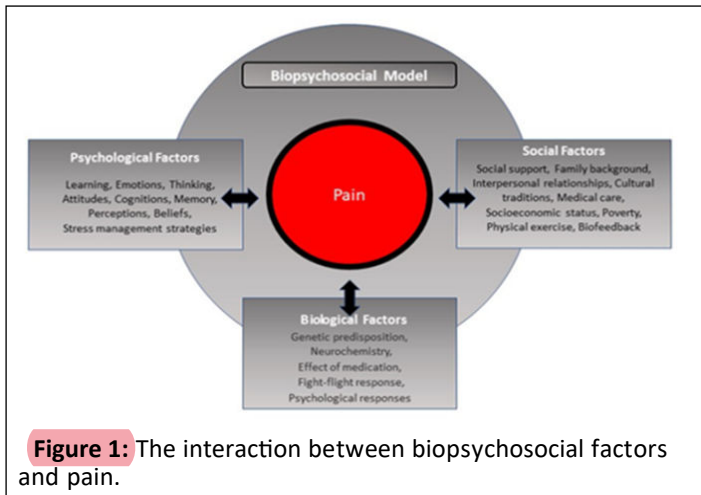
Figure 1: The interaction between biopsychosocial factors and pain.

Genetic susceptibility

The intensity of pain perception is influenced by genetic factors. Many studies have been undertaken until now in order to prove this association. **Table 1** lists a number of genes that have been associated with chronic pain [5]. These genes encode receptors and neurotransmitters. Mutations and Single-Nucleotide Polymorphism (SNPs) in deoxyribonucleic acid (DNA) could partly explain the many differences in pain sensitivity. Also, genes encode cytochromes (CYP 450) associate with pain because they change the amount of analgesic drug availability in the bloodstream. Genes encoding receptors and neurotransmitters are now known to play a significant role in pain perception [5].

Gene	Risk of pain
GCH1 (gene encoding cyclohydrolase 1)	Decreased
SLC6A4 (serotonin transporter gene)	Increased
ADRB2 (gene coding for β 2 adrenergic receptor)	Increased
HTR2A (gene coding for serotonin receptor 2A)	Increased
SCN9A (gene encoding for Na+ Channel)	Increased
KCNS1 (gene encoding for K+ Channel)	Increased
CACNA2D3 (alpha 2 delta 3 subunit of voltage-dependent Ca+2channel)	Reduced
CACNG2 (gene encoding for the gamma 2 subunit of voltage-dependent Ca+2 channel, also known as 'stargazin')	Increased
SLC6A4 (serotonin transporter gene)	Increased
ADRB2 (gene coding for β2 adrenergic receptor)	Increased

Table 1: Genes associated with chronic pain.

Furthermore, gender is an essential factor, while men and women have different responses to pain. Studies have shown that women are more sensitive to pain than men. Pain perception is influenced by genotype, opioid receptor function, and hormonal differences between the genders. For example, women with higher oestradiol levels have decreased pain sensitivity and increased brain μ-opioid receptor binding than women with low oestradiol levels [6].

Socioeconomic factors

Pain can be exacerbated by social factors such as social isolation and rejection. Because of the constraints imposed by COVID restrictions this period has established, these phenomena could presumably now be increased. These factors seem to activate the brain's regions most associated with physical-social pain, such as the brain's cingulate and insular cortices. An increase in sympathetic activity and reduced activation of the Descending Pain Modulatory System (DNIC) has been observed [1]. Furthermore, low socioeconomic status and poverty may trigger painful stimuli, and the daily stress experienced by these people reduces DNIC activation [1].

The role of negative appraisal and beliefs in the perception and management of chronic pain was the subject of various studies. Pain catastrophizing is shown to be a strong predictor of pain severity. It seems to be characterized by a tendency to magnify the threat of pain and feel helpless in pain and the inability to prevent pain-related thoughts either in anticipation, during, or after the painful encounter. Several studies have focused on limbic brain regions associated with the unpleasantness of pain. Increased activity within the prefrontal cortex, Anterior Cingulate Cortex (ACC), and hypothalamic pituitary adrenal axis dysfunction have been observed. This suggests alterations in endogenous pain modulatory pathways [7].

Psychological factors

The social determinants of pain, such as injustice perceptions, social exclusion, stigmatization, pain catastrophizing, depressed mood, motivation, anxiety, and fear, seem to aggravate or minimize pain [8]. Stress is another factor that is often seen in patients suffering from chronic pain. Increased stress or, more appropriately, psychological distress is defined as an alternation of emotion and mood in which psychological and physiological symptoms occur. It is well mentioned that stress causes pain. On the other hand, pain causes stress. Also, it causes structural remodelling of the brain, and the pain becomes chronic [9]. Last but not least, stress activates b2 receptors due to sympathetic nervous system hyperactivity, resulting in muscle tenderness.

Pain strongly activates the brain's areas associated with emotional processing, such as the bilateral amygdala, caudate, orbitofrontal cortex, hippocampus, hippocampal gyrus, and the superior temporal pole [10]. Recently a connection between chronic pain and depression has been observed [11]. Chronic pain can significantly reduce dopamine levels, a hormone associated with reward-motivated behaviour and happiness [11, 12]. This mechanism occurs in the limbic midbrain area, where imaging studies have shown reduced dopamine stimuli in patients with chronic pain [11, 13]. Psychological factors can amplify patients' perceptions of pain.

Physicians' training

The Pain Psychology Task Force of the American Academy of Pain Medicine recently conducted a national study and issued the first report on pain psychology training, perspectives, resources, and needs in the United States. According to the findings of this study, 72 percent of therapists and psychologists acknowledged having little or no formal pain training, and 55 percent supported low comfort levels in addressing and treating pain.

Furthermore, 90% of therapist and psychologist respondents expressed interest in free pain education for psychologists [8]. This result and the biopsychosocial elements that influence the patient's perception of pain make effective management exceptionally challenging.

Management of the Biopsychosocial Model

Biological factors

It is well understood that there are numerous difficulties in gene silencing in our daily clinical practice due to the many unknown polymorphisms in genes, as well as many bioethical issues. However, a recent study by Moreno, et al. [14], which was conducted in mice, suggests that the clustered regularly interspaced short palindromic repeats-Cas9 (CRISP-Cas9) new technique could reduce or block genes (polymorphisms) encoding channels (NaV1.7 at Neuro2A cells in lumbar dorsal root ganglia). Hence, an effective reduction in pain sensitivity occurs. Perhaps similar studies in humans will be conducted soon [14].

Psychological factors

Patients with chronic pain who are also depressed are expedited by combining antidepressant medication. Tricyclic drugs (e.g., amitriptyline) have antidepressant effects, reduce pain and improve sleep. Also, a significant number of studies have been found to be effective in treating several types of pain, e.g., neuropathic. However, they have many side effects such as constipation, dry mouth, and not being well tolerant to many patients. Relief of depression permits the patient to take more responsibility for their musculoskeletal system and engage in exercises to help them recover [15, 16]. Also, they increase the activation of DNIC [1].

Stressful stimuli on patients with pain must be recognized and eliminated as they affect the patient's perception and cognitions related to the stimulus and are associated with physiological responses and reinforcement of painful physiological responses. It may be required to teach a person how to deal with stressful situations better. This may involve training in social skills and problem-solving strategies [17]. Cognitive-behavioural therapy seems to increase patients' control over pain based on the principle that a person's beliefs, attitudes, and behaviours play an important role in the experience of pain [1].

The perception and management of pain differ from patient to patient and have the features of a psychosomatic disorder. Meditation contributes to mental relaxation while lowering cortisol levels, decreasing sympathetic activity, and activating areas in the brain responsible for emotion regulation [18].

Pain Education

Insufficient training is one of the underlying causes of therapist and psychologist discomfort in treating pain aligns with the cause of physician discomfort with this patient population. Pain education experts have advocated for improved and expanded pain education in medical schools, emphasizing the cognitive and affective elements of the pain experience. However, the national survey findings on pain psychology indicate that while medical providers may acknowledge the value of the biopsychosocial model of pain approach, they appear to be lacking the resources to implement it in their practices.

More than ever, we must expand pain education in the field of psychology so that sufficient numbers of well-prepared and trained psychologists and mental health professionals are equipped to empower their patients who suffer from pain [8]. The results of a systematic review conducted by Marris, et al. [19] suggest that the combination of pain education strategies with the interventions provided by physical therapists demonstrates a moderate to large effect size on pain and disability constructs. Still, unfortunately, it lacked pooled statistical significance [19]. That underlines the need for more and better clinical trials on that topic. Furthermore, it is also critical to learn how to collaborate with professionals from other fields of interest to deal with multi-dimensional problems such as chronic pain and achieve the greatest possible outcome for the patient.

Conclusion

Chronic pain is a widespread occurrence, and its multi-dimensional and complex nature necessitates a more holistic and personalized approach to treatment from physicians. The biopsychosocial model describes how biological, psychological, and social factors interact to influence pain intensity. Therefore, if the pain persists for more than 3 months, physicians should not ignore the Biopsychosocial model.

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