REVIEW ARTICLE

CONTENTS

Pain epistemology and treatment approaches

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ABSTRACT

Aim: To investigate the epistemology of chronic pain, the methodology of approaches to its treatment, and to highlight the economic and social aspects related to the issue of chronic pain.

Materials and Methods: A comprehensive literature search was conducted using the following databases: Google Scholar, PubMed, Scopus, Web of Science, and SpringerLink. The search included combinations of the following key words: chronic pain, causes of pain, biopsychosocial model of pain, multimodal pain management, economics of chronic pain. The search covered publications from 1994 to 2025. Studies were selected based on the following inclusion criteria: peer-reviewed articles, meta-analyses, systematic reviews. The following were excluded from the search: conference abstracts, editorials, commentaries. The initial search yielded over 90 publications. After checking for relevance, 34 articles were included in the final review.

Conclusions: Pain is dualistic, both in origin and in its mechanisms of implementation. It is simultaneously a physical sensation and an emotional reaction, encompassing cognitive and social components. Convincing evidence has been obtained regarding the presence of functional, structural, and chemical changes in the brain that occur due to continued pain. Chronic pain is a complex biopsychosocial concept. Therefore, the development of a biopsychosocial model of pain is needed, both along the lines of patient–society and patient–medicine, as well as incorporating feedback. Only targeted multimodal medical care, together with a transformation in the sociocultural perceptions of patients with chronic pain, allows improvement in treatment outcomes, economic efficiency, and social adaptation of affected individuals. This requires an appropriate multidisciplinary approach and wide implementation of innovative methods and techniques of medical care for patients with pain syndromes, taking into account the biopsychosocial model of pain.

KEY WORDS: chronic pain, treatment

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INTRODUCTION

Chronic pain is one of the most burdensome conditions and one of the most common chronic diseases, as its incidence reaches epidemic levels, and the economic losses associated with providing care to patients with chronic pain syndromes outweigh the costs of cardiovascular disease, cancer, and diabetes combined. In the United States, the Institute of Medicine, a non-profit non-governmental organization, recently published a report estimating that healthcare costs due to lost productivity were up to $635 billion in 2010. This is significantly higher than the estimated costs for heart disease ($309 billion), diabetes ($188 billion), and cancer ($243 billion) [1]. Chronic pain is a major challenge for healthcare systems in various countries due to its international prevalence, associated disability, economic burden, and high utilization of healthcare services by sufferers. In the latest Global Burden of Disease systematic review, pain-related conditions such as chronic back pain, headache, depression, and others are identified as ten main causes of disability in the age group 10–49 years worldwide, representing a global cause of disability in both developed and developing countries [2]. The results of studies by many authors show a significant burden of pain in Europe and the USA [3–5]. Pain is a global medical and socio-economic problem that requires complex, comprehensive solutions at the state and administrative level, new methodologies of biological and socio-cultural orientation, and new technologies and techniques aimed not only at the patient suffering from chronic pain, but also at society. The subjective origin of pain, its duality, the lack of a clear biomarker, and insufficient understanding of its mechanisms make it difficult to determine the pathological cause of chronic pain and the effectiveness of its treatment. The biopsychosocial model of pain has not yet been clearly defined or applied to the social aspects of chronic pain, both from the patient's perspective and the sociocultural environment. As a result, social aspects have yet to be fully considered in theoretical models of chronic pain and practically implemented to benefit patients suffering from it. Consequently, a number of medical,

economic, and social problems related to providing effective care to a large number of such patients remain unresolved [6]. The biopsychosocial model of pain has the potential to shift multi-directional societal efforts toward significant improvement in the outcomes of chronic pain treatment and the reduction of suffering in these patients.

AIM

The aim of the research was to investigate the epistemology of chronic pain, the methodology of approaches to its treatment, and to highlight the economic and social aspects related to chronic pain.

MATERIALS AND METHODS

This review of chronic pain was conducted to clarify the biopsychosocial causes of pain, their correlation and multifaceted approaches to its treatment. To highlight the economic and social aspects associated with the problem of chronic pain.

A comprehensive literature search was conducted using the following databases: Google Scholar, PubMed, Scopus, Web of Science, SpringerLink. The search included combinations of the following key words: chronic pain, causes of pain, biopsychosocial model of pain, multimodal pain management, economics of chronic pain.

The search covered publications from 1994 to July 2025, starting from the proposed definition of chronic pain and its classification by the International Association for the Study of Pain (IASP) with coverage of the latest available literature.

Studies were selected based on the following inclusion criteria: peer-reviewed articles, meta-analyses, systematic reviews. The following were excluded from the search: conference abstracts, editorials, commentaries.

The initial search yielded over 90 publications. After checking for relevance, 34 articles were included in the final review.

ETHICS

This review article is based on an analysis of publicly available scientific data published in peer-reviewed journals, clinical guidelines, and databases. No patient-identifying data were used during the work, and no approval from an ethics committee was required, as the study did not involve new clinical interventions or primary collection of patient information.

The authors adhered to the ethical principles of the Declaration of Helsinki of the World Medical Association and international standards for publication in medical journals, including the recommendations of the ICMJE (International Committee of Medical Journal Editors).

No element of the work contains plagiarism or fabrication of data. All sources of information are appropriately cited and properly formatted.

FRAMEWORK

The study was conducted as a fragment of the Scientific Department of Minimally Invasive Surgery scientific project (State Institution of Science «Center of innovative healthcare technologies» State Administrative Department) «Optimization of approaches to providing specialized medical care for surgical patients using personalized anesthetic support» (state registration number 0125U000315; term: 2025-2029).

REVIEW AND DISCUSSION

PHILOSOPHICAL AND PHILOLOGICAL ASPECTS OF THE UNDERSTANDING OF PAIN

Pain is a sensation, which means that it is subjective, and therefore, there are no clear criteria for its measurement. Pain accompanies a person throughout life, performing, on the one hand, a functional, either protective or destructive, role, and on the other, indicating its source, whether bodily or spiritual. Already at the level of world perception and linguistic forms of pain expression, its duality is evident: external–internal, bodily–spiritual, concept–sensation. From a philosophical perspective, the cause of pain is dual: it is, on the one hand, an obstacle that a person seeks to overcome, and on the other, a universal mechanism that warns of danger and mobilizes the body's resources. Pain is both a universal physiological process and a deeply individual experience.

Analysis of ideas about pain in a sociocultural context allows for an assessment of the level of humanity, culture, and rationality within a society. European culture tends to eliminate pain as a factor of discomfort that interferes with normal life. However, such alienation of pain creates an imbalance: the direct sense of reality is lost, natural bodily self-regulation is disrupted, and the ability to orient oneself to the body and adapt to internal and external changes is weakened. This leads to a disconnection from the body, breaking the unity of body and spirit (psyche, somatics, consciousness), which in turn causes a crisis of personality and its interaction with the external world–conceived as an extended space of one's body. Civilization, in its technological overcoming of pain, ultimately deprives a person

of the right to personal choice. Pain contains a primary reflex shared by all living beings. At the same time, in the human body, the natural process of perceiving and independently experiencing pain is contested.

The analysis of linguistic forms of pain expression, which reflect the duality of its origin and its structural and functional components, is an important aspect [7]. The word "pain" in Greek is interpreted through άλγος and πόνος, which denote not only pain but also suffering, grief, sadness, trouble, longing, hard work, tension, and torment. The English word pain comes from the Latin poena, "punishment, torment," which frames the perception of pain as a form of punishment for sin. Notably, the concept of "pain" is not inherently negative; it does not indicate absence or lack but rather emphasizes presence. The lexical material reflects philosophical and medical ideas about the duality of pain, encompassing both physical and psychological dimensions and combining destructive and protective aspects.

Traditionally, in the interpretation of the concept of pain, a distinction is made between physical and mental pain, the latter more often being referred to as suffering. In European culture, there exists a hierarchy of pain, according to which physical pain is considered worse than mental pain; hence, the punishment of criminals historically involved corporal punishment. It is believed that mental torment can be experienced in despair, whereas physical pain does not allow one to disengage from the present moment of being. However, the ancient Greek philosopher Epicurus, by contrast, considered mental pain to be worse, since the body suffers only from events in the present, while the soul suffers from both the past and the future. The duality of the origin of the pain sensation is implemented through complex, heterogeneous mechanisms operating in two directions: from the body to the soul and vice versa. This biological mechanism provides a dualistic perception and understanding of suffering, both physical and spiritual. In essence, these are two sides of the same biological process, which is crucial for regulating behaviour and ensuring the survival of the individual.

DEFINITION OF PAIN, CLASSIFICATION, AND MANIFESTATIONS

The recognition of chronic pain as a distinct pathological unit is still disputed. This issue is considered in a historical context in the study of William Raffaeli and Elisa Arnaudo "Pain as a disease: an overview"; the authors draw attention to this global medical problem that requires further research and development of new specific therapeutic approaches [8]. The International Association for the Study of Pain (IASP), presented at the first Global Day Against Pain, notes that "chronic and recurrent pain is a separate health problem, a distinct disease" [9]. This is widely supported by leading scientific societies dealing with pain issues and is still a matter of debate in the scientific community. The main question is whether chronic pain, already recognized as distinct from pain as a symptom, can be considered as an independent pathology. In 2015, the IASP Working Group on the Classification of Chronic Pain suggested a new system for categorizing pathological pain conditions for the ICD11 [10].

The IASP (1994) [11] defines pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage. In 2016, the IASP clarified this definition: pain is an unpleasant sensation associated with actual or potential tissue damage with sensory, emotional, cognitive and social components. This is an essential addition, since it allows for interpretation and influence on the course of the disease as pain always contains a subjective component.

Pain can be classified according to mechanism, duration, aetiology, and location. By mechanism, pain is divided into nociceptive (resulting from damage to pain-sensitive structures) and non-nociceptive (neuropathic or psychogenic). Nociceptive pain can be further subdivided into somatic and visceral types, depending on which areas of the body the nociceptors are activated. Neuropathic pain is classified as peripheral or central, depending on which parts of the nervous system are responsible for maintaining pain and are damaged. Chronic pain is defined as pain that persists beyond the usual period of acute injury or illness, or that recurs over months or years [12]. The definition of chronic pain is further specified by duration: pain that continues or recurs for more than three months, exceeding the expected time for healing and tissue repair after damage [13]. High-intensity chronic pain (HICP) is also distinguished, referring to pain that limits life or work on most days, or every day, over the past three months.

Pain can be classified as somatic, visceral, or a combination of both, depending on the anatomical characteristics of the tissues involved. Somatic pain, which occurs in the joints, muscles, and skin, is typically well localized. Visceral pain, originating from internal organs, is usually poorly localized and diffuse due to the involvement of multiple spinal segments and the phenomenon of convergence. In addition, visceral pain is often accompanied by somatic pain due to the convergence of afferent pathways of visceral and somatic nerves [14]. The American Academy of Pain Medicine suggests distinguishing two types of pain using new terminology: good (eudynia) and bad (maldynia) pain.

Good pain serves as a symptom of an underlying pathology, disease, or injury, whereas bad pain represents a pathological process associated with neuropathological changes at the cellular and molecular levels [15].

Chronic pain is frequently accompanied by anxiety and depression, fatigue, sleep disturbances, functional disability, and reduced quality of life. Pain is both a physical sensation and an emotional response, encompassing cognitive and social components. Thus, this process is bidirectional: pain affects behaviour (emotional and social), and conversely, behaviour influences the manifestations and course of pain. The presence of verified structural changes in tissues that generate pain syndromes is a key factor in their development. Structural changes, for example in the spine, can act as a persistent or periodic trigger of pain, such as in cases of back pain. Pain caused by structural changes in the spine is understandable, and its mechanisms are clear. However, the presence of significant structural changes does not always correspond to persistent or severe pain. Conversely, individuals often experience long-lasting debilitating back pain with no significant structural abnormalities. Why? Pain is, on the one hand, a manifestation of tissue damage, and on the other, psychological mechanisms may also contribute to its development. This phenomenon, known as somatization, occurs when psychological disorders and conflicts are transformed into somatic complaints in a subconscious attempt to reduce mental stress. The model of disease behaviour emphasizes cognitive (evaluative) factors and considers the influence of the external environment as a primary mechanism in shaping an individual's perceptions of their health.

Muscle tension is the basis of the psychosomatic mechanism, which leads to regional discomfort, and the evidence of effectiveness of relaxation and various local blockades confirm the presence of such a mechanism. From the patient's subconscious point of view, a "benefit" is developed from the feeling of pain – the avoidance of a mental conflict by transforming it into a physical illness. A way to resolve unconscious conflicts. If the conflict is not allowed into consciousness, it is unresolved, and the constantly increasing mental tension is always ready to be discharged. The release of restraining energy causes an exacerbation of the reaction to ordinary or mild pain stimuli. People suffering from chronic pain feel a certain dissatisfaction, face both passive and active exclusion from social participation, family interaction and professional activities. The experience of communicating with patients with chronic pain shows that the forms of their misunderstanding, rejection and ostracism greatly outline their suffering. These aspects exacerbate the problem of socialization of patients; their exclusion from social life becomes real, which is an important part of the suffering of patients with chronic pain. Chronic pain is a complex bio-psycho-social phenomenon with broad consequences not only in terms of clinical care, but also in terms of social and economic impact [16-18].

Thus, an important aspect of pain syndrome is the possible psychological mechanisms of its development, in particular through somatization and the corresponding psychosomatic processes based on muscle overstrain, which causes regional discomfort. Psychological disorders and contradictions are transformed into somatic complaints in a subconscious attempt to reduce mental stress. The manifestation of a mental disorder through physical symptoms is common in such cases. The results of psychoanalysis show that pain reduces the pleasure of a dependent position and sexual needs, dissipates aggression as well. Anger can be manifested indirectly in the form of aggressive and passive behaviour, when family members, the attending physician become hostages to endless complaints and demands for attention from the patient. In modern society, the majority believes that more attention is given to physical diseases than psychological ones that contributes to expression of complaints in organic pathologies. The behavioural choice model indicates that cultural and social factors encourage people to express complaints in somatic categories in order to avoid the social condemnation associated with mental disorders.

Convincing evidence that chronic pain is accompanied by functional, structural and chemical changes in the brain is presented in a 2009 review [19]. Pain becomes pathological when it loses its signalling function and as a result of psychophysiological changes becomes a destructive factor that is difficult to cope with using traditional methods of therapy. Recognizing chronic pain as a distinct pathological condition could significantly contribute to raising awareness of this global problem among both medical professionals and the public. The ability to modulate the pain response (enhance or suppress it) is crucial and is implemented at the cortical, brainstem, and spinal levels.

MECHANISMS OF PAIN DEVELOPMENT

There are three primary mechanisms of pain response modulation: gate control, the descending modulatory system, and neuromodulators [14]. The gate control theory, first proposed by Wall and Melzack in 1965, explains that the transmission of nociceptive signals at the primary synapse between nociceptors (primary nociceptive fibres) in the dorsal horn of the spinal cord can be modulated or blocked. This mechanism has been described in detail in subsequent studies [20].

The pain pathway begins with the activation of nociceptors. It is a complex and heterogeneous process involving several interconnected mechanisms regulated by the nervous, endocrine, and inflammatory systems, and is accompanied by the modulation and amplification of the response through complex biochemical changes [21].

In cases of tissue damage, the local immune balance is disturbed. Damaged cells, activated mast cells, neutrophils, and macrophages release inflammatory mediators (hydrogen ions, sodium ions, serotonin, cytokines, bradykinin, histamine, prostaglandins, leukotrienes) that activate and sensitize local transient receptor potential (TRP) channels on nociceptors. Specific TRP channels play a key role in the maintenance of chronic pain [22] and are also involved in the development of hyperalgesia, as they can be sensitized by inflammatory mediators [23]. Therefore, early control of the local inflammatory response is crucial to prevent peripheral sensitization.

The descending modulatory system can exert both inhibitory effects, by reducing signal transmission at the primary synapse, and excitatory effects, by facilitating transmission at the primary synapse, which contributes to central sensitization. With repeated or prolonged nociceptive stimulation, central sensitization develops and is maintained at the level of the spinal cord. This is a critical process in the development and maintenance of chronic pain, resulting in a persistent state of pain hypersensitivity [24]. Early prevention of sensitization through optimal analgesia during the acute period of a pain syndrome is essential for preventing the development of chronic pain, regardless of the cause of tissue damage, such as trauma or inflammation.

Feedback mechanisms are also significant, as patients suffering from depression or anxiety have an increased tendency to experience more severe pain following traumatic events or medical procedures. Therefore, clinicians should always consider the importance of psychological interventions, particularly cognitive-behavioural therapy, in the comprehensive management of chronic pain, and combine these with therapy for depression and anxiety [25].

The third group of mechanisms involved in the implementation and modulation of the pain response operates through neuromodulators. Neuromodulators are molecules that modulate the efficiency of neurotransmitter signal transmission at the synapse and can be either excitatory or inhibitory. Excitatory neuromodulators that enhance nociception include cholecystokinin-8 (an endogenous anti-opioid), prostaglandins, dynorphin 1-17, orphanin FQ, and nociceptin. Inhibitory neuromodulators that suppress nociception include opioids, cannabinoids, acetylcholine, orphanin FQ, and nociceptin [14]. Neuromodulators play a crucial role in the endogenous control of pain intensity.

It is also established that pain has a genetic component [26]. Currently, genes associated with the pathology of the afferent component of pain sensitivity have been identified. These genes encode approximately 50 neurotransmitters, their receptors and transporters; 8 ion channels; 15 anti-inflammatory cytokines and their receptors; approximately 15 neurotrophic factors and their receptors; and more than 15 intracellular messengers. This suggests that pain perception can potentially be regulated by targeting specific genes [27].

TREATMENT APPROACHES

The world requires innovative organizational, structural, social, and medical approaches to understanding and treating chronic pain. According to the World Health Organization (WHO), approximately 50% of patients with various types of pain worldwide do not receive appropriate therapy, highlighting the significant challenge faced by professionals involved in pain management.

Given the unsatisfactory outcomes of chronic pain treatment, a biopsychosocial model of pain is necessary from both the patient–society and patient–medicine perspectives. This model frames patient and societal behaviour in a broader context, enabling a more comprehensive approach to addressing the often-overlooked aspects of suffering experienced by patients with chronic pain. Considering the exhausting struggle of these patients for recognition, attention should be given to social factors, which must be carefully considered theoretically and implemented in practice to help patients adapt and participate more fully in society [28].

The dualistic origin of pain reflects, on the one hand, possible sources of pain (damage to the soma and/or dysfunction of the nervous system) and, on the other hand, the interdependence between pain and emotions, which allows for the interpretation of various factors influencing the course of the disease. This understanding significantly affects the selection of medical treatment strategies and the development of a comprehensive recovery program for individual patients, encompassing medical devices, technologies, therapeutic methodologies, and social rehabilitation. Chronic pain also negatively impacts quality of life due to unmet needs in pain management; surveys on the quality of life of such patients indicate a high prevalence of problems related to mental health, employment status, sleep, and personal relationships.

Two primary factors should be distinguished in the development of most chronic pain syndromes: somatic

(most often inflammatory, compressive, musculoskeletal, autonomic, or vascular) and psychogenic, or a combination of both. This distinction is crucial for selecting appropriate treatment strategies, as understanding the causes and pathogenetic components of pain determines the therapeutic approach. The management of chronic pain requires the cooperation of multiple specialists and a comprehensive, multidisciplinary approach to patient care [29].

A call to action is needed for administrators and policymakers to recognize the significance of chronic pain and to invest in comprehensive strategies encompassing structural organization, prevention, education, and access to effective treatment methods. Recent advances in chronic pain management include a wide range of approaches, primarily minimally invasive techniques [30], pharmacological therapies [31], non-pharmacological interventions [32], psychological interventions [33], and complementary or unconventional treatment methods [34].

The expansion of medicine into increasingly narrow specialties is not without limitations. When each physician focuses solely on "their" pathology, a holistic perception of the patient is lost. Conversely, the multidisciplinary approach also has its constraints. The next stage in the development of effective medical care, including for patients with chronic pain, lies in the integration of medical knowledge to ensure more comprehensive and effective treatment. The future belongs to integrative medicine.

CONCLUSIONS

The problems associated with chronic pain are a real financial burden to every country. Governments need to be aware of pain issues, and managers at different levels and politicians should necessitate the importance of strategies, both medical and social, for investment in comprehensive policies that cover structuring, prevention, education and available effective treatment methods. Taking into account the significance of this health issue and the associated economic and social burden on viability, chronic pain should be considered a priority in the health care system of states. The complexity of the mechanisms of origin of pain from purely structural, somatic to psycho-social and combined require appropriate mechanisms for rehabilitation of pain syndrome depending on its manifestations, development and duration, starting from psychological, corrective behavioural, informational, social to minimally invasive contemporary interventions, medication, physiotherapy, and traditional medicine.

Main approaches to improvement of medical care to patients with chronic pain:

1. A bio-psycho-social approach to understanding the development of chronic pain should be chief in overcoming this suffering. Balanced multifaceted relationships of the patient with public/private regulatory authorities, medical professionals, family, professional and home environment should play an important role in improving the quality of their life.
2. A multidisciplinary approach to the treatment of patients with chronic pain using multimodal, especially minimally invasive interventions should be used; the doctors should willingly implement innovative methods and techniques for providing medical care to patients with pain syndromes.
3. Specialized medical units of various structures should be expanded to enable the rapid and effective management of vertebrogenic, vegetative, traumatic, pelvic, psychogenic, cephalic, cancer-related, and other pain syndromes. Pain syndromes should be alleviated as quickly as possible, "here and now," through a combination of minimally invasive surgical techniques, pharmacological treatments, and psychological interventions.
4. Improving awareness of the medical personnel, their training, certification of knowledge; awareness of all social components surrounding and contacting patients suffering from pain.

Considering the alarming epidemiological data on the global prevalence of chronic pain and the unsatisfactory outcomes of its treatment, further systematic research is needed on the medical aspects of pain, including its epidemiology, diagnostics, course, and treatment methodologies. Additionally, there is a need to develop clinical examination protocols and treatment strategies for various types of pain, taking into account the biopsychosocial model of pain.

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CONFLICT OF INTEREST
The Authors declare no conflict of interest

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