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CHRONIC PAIN

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Abstract: Chronic pain, defined as pain lasting longer than three months or beyond normal tissue healing time, is increasingly recognized as a distinct condition rather than simply an extension of acute pain. It affects a substantial portion of adults worldwide and imposes profound individual, societal, and economic burdens. Emerging neuroscientific, psychological, and social research highlights that chronic pain arises from complex interactions of biological sensitization, altered central nervous system modulation, psychosocial factors, and behavioural responses. Effective management demands a biopsychosocial approach combining pharmacological and non-pharmacological therapies, tailored rehabilitation, and psychological support. Despite advances, many patients continue to suffer, underscoring the need for improved diagnostic clarity, novel therapeutic targets, and integrated care models.

Keywords:chronic pain; pathophysiology; central sensitization; biopsychosocial model; pain management; quality of life; epidemiology

Pain is a universal human experience, playing an adaptive role by signalling potential tissue damage or threat. However, when pain persists beyond normal healing time—commonly defined as more than three months—it transitions into what is referred to as chronic pain. Chronic pain is no longer merely a symptom but is increasingly viewed as a distinct clinical entity with its own classification, pathophysiology, and treatment challenges.

This article aims to review the current understanding of chronic pain, including its epidemiology, underlying mechanisms, and management strategies, with the goal of equipping clinicians, educators and policy makers with a consolidated overview.

Epidemiology and burden

Chronic pain is highly prevalent globally. A 2019–2021 U.S. survey estimated that approximately 20.9% of U.S. adults (about 51.6 million persons) experienced

chronic pain lasting ≥3 months, with 6.9% experiencing “high-impact chronic pain” that substantially restricted daily activities. In Europe and other high-income regions, prevalence estimates among adults approach 19% or higher.

The impact is considerable: chronic pain is a leading cause of disability, diminished quality of life, lost productivity, and increased healthcare utilisation.

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Risk factors for the development of chronic pain include older age, female sex, low socioeconomic status, prior acute pain episodes, psychological distress (e.g., depression, anxiety), and multisite pain.

Pathophysiology and mechanisms

Unlike acute pain that primarily serves a protective purpose, chronic pain is characterised by maladaptive changes and loss of the protective warning function. Key mechanistic themes include:

Central sensitization and altered pain modulation

In chronic pain states, the central nervous system (CNS) becomes hyper-responsive: neurons in the spinal cord and brain exhibit increased excitability, decreased inhibitory control, and augmented response to stimuli (even non-noxious ones). Neuroimaging studies reveal altered functional connectivity in brain regions such as the insula, anterior cingulate cortex and prefrontal cortex.

Neuroimmune and glial activation

Emerging evidence implicates activation of glial cells and neuroimmune signalling in the maintenance of chronic pain. These mechanisms contribute to persistent pain via release of cytokines, enhanced excitability, and disordered synaptic modulation.

Biopsychosocial interplay

Psychological factors (e.g., catastrophizing, fear-avoidance), social factors (work status, cultural beliefs), and behavioural responses (sedentarism, sleep disruption) contribute substantially to both the development and persistence of chronic pain.

Classification and heterogeneity

Chronic pain is not monolithic: there are nociceptive (due to tissue damage), neuropathic (due to nerve injury), nociplastic (altered pain processing without clear tissue or nerve damage) mechanisms, often overlapping in the same individual.

Clinical diagnosis and assessment

Diagnosis of chronic pain begins with a careful history and physical examination to identify possible underlying causes (e.g., joint pathology, nerve compression) and to evaluate the pain's duration (>3 months) and impact on function. Assessment should also screen for psychological comorbidities (e.g., depression, anxiety), sleep disruption, opioid misuse risk, and social factors.

Classification according to pain mechanism and impact (e.g., high-impact chronic pain) aids in tailoring management. Multidimensional assessment tools and imaging may be used when indicated.

Management strategies

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Effective management of chronic pain is necessarily multimodal and tailored to the individual. Key strategies include:

Pharmacological treatments

NSAIDs, acetaminophen: may help in nociceptive pain, though long-term benefit is limited.

Neuropathic pain agents: e.g., gabapentinoids, certain antidepressants (duloxetine) for neuropathic or nociplastic pain.

Opioids: although used, they carry risk of dependence, tolerance, and increased morbidity/mortality; guidelines emphasise caution.

Non-pharmacological treatments

Physical rehabilitation: aerobic exercise, strength training, stretching, posture correction.

Psychological therapies: cognitive behavioural therapy (CBT), mindfulness, acceptance and commitment therapy (ACT) to address catastrophizing, fear-avoidance, sleep issues.

Interventional procedures: nerve blocks, spinal cord stimulation, though effectiveness varies and long-term benefit may decline.

Integrated biopsychosocial care

Given the multifactorial nature of chronic pain, the biopsychosocial model is central: combining medical, physical, psychological and social interventions yields better functional outcomes.

Challenges and gaps

Major challenges in chronic pain management include:

Under-recognition of chronic pain as a disease entity in its own right.

Variable response to treatments, with many patients achieving only modest relief (e.g., ~30% pain reduction) and persistent functional limitations.

Risk of opioid misuse and lack of access to non-pharmacological therapies in many settings.

Heterogeneity of patient presentations and lack of biomarkers to stratify treatment.

Disparities in access and outcomes across socioeconomic, cultural and geographic groups.

Implications for practice and policy

For educators, clinicians and policy-makers:

Prioritise early intervention in acute pain to prevent transition to chronicity.

Adopt a biopsychosocial framework in teaching and practice.

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Promote multidisciplinary pain clinics and ensure access to physical and psychological therapies.

Encourage research into mechanisms, treatment stratification and outcome measurement beyond pain intensity (e.g., function, quality of life).

Advocate for public health recognition of chronic pain as a priority condition requiring resource allocation.

Conclusion

Chronic pain is a complex, multifactorial condition that extends far beyond the duration of healing. Understanding its mechanisms—from central sensitization to psychosocial influences—helps frame more effective and holistic management approaches. While significant progress has been made, many individuals remain underserved. Bridging the gap requires integrated care, research into novel therapies and systemic change in how pain is viewed in both medicine and society.

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