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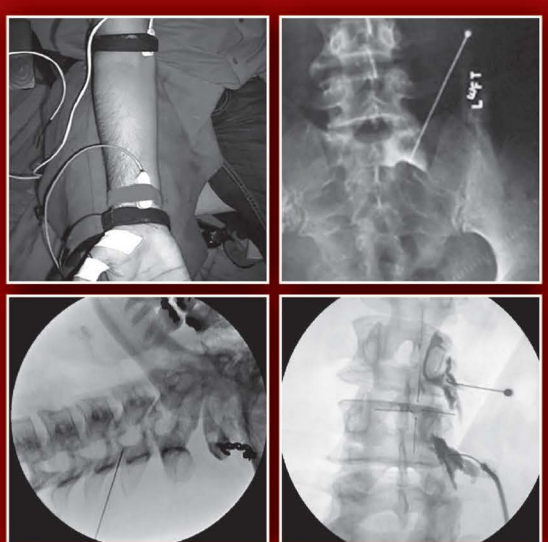
2nd Edition

Symptom Oriented Pain Management



Editors
Dwarkadas K Baheti
Sanjay Bakshi
Sanjeeva Gupta
Raghbir Singh P Gehdoo

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CONTENTS

SECTION 1: BASICS

1. **Pain Management: A Historical Perspective** 3
   Vasumathi M Divekar
2. **Acute Pain** 6
   Gerard DeGregoris III
3. **Acute Turn to Chronic: Causes, Prevention, and Management** 10
   Ramon Go, Neel Mehta
4. **Chronic Pain** 19
   Neel Mehta, Timothy Connolly
5. **Interpretation of Blood Levels of Drugs Used in Chronic Pain Management** 27
   Urmila M Thatte, Maulik S Doshi

SECTION 2: CLINICAL EXAMINATION AND EVALUATION

6. **Clinical Examination and Evaluation of Cervical Spine** 43
   Vivek Mehta, Kavita Poply
7. **Clinical Examination and Evaluation of Lumbar Spine** 52
   Steve M Aydin

SECTION 3: UNDERSTANDING IMAGING MODALITIES FOR PAIN PATIENT

8. **Interpretation of X-ray Spine** 61
   Muthusamy Chandramohan
9. **Interpretation of Computer Tomography Scans for Interventional Pain Treatment Procedures** 71
   Sunil A Waghmare
10. **Magnetic Resonance Imaging in Pain Management** 83
    Makarand M Kulkarni
11. **Role of Electrodiagnosis in the Management of Neck and Back Pain** 100
    Mansukhani A Khushnuma
12. **Bone Mineral Density: Interpretation, Treatment, and Prevention** 109
    Shirish Kataria

SECTION 4: CERVICAL/NECK PAIN

13. **Headache: Causes and Treatment Modalities** 123
K Ravishankar

14. **Trigeminal Neuralgia: Causes and Treatment** 132
Manohar L Sharma

15. **Cervical Radiculopathy Pain and Its Management** 146
Ganesan Baranidharan

16. **Cervical Facet Joint Pain and Its Management** 152
Sherdil Nath

17. **Cervical Diskogenic Pain and Its Management** 157
Anil K Sharma

SECTION 5: LOW BACK PAIN

18. **Focal Back Pain and Its Management** 163
Sanjeeva Gupta, Shamim Haider, John A Titterington

19. **Lumbar Facet Joint Pain Syndrome** 172
Sanjay Bakshi, Gerard Grahemsen

20. **Lumbar Spinal Stenosis** 180
Steve M Aydin, Thomas P Lione

21. **Lumbar Diskogenic Back Pain** 187
Selaiman Noori, Sudhir Diwan, Neel Mehta

22. **Sacroiliac Joint Pain Syndrome and Its Management** 198
Andrew R Cooper

23. **Coccygodynia and Its Pain Management** 204
Yashwant L Nankar

24. **Piriformis and Iliopsoas Pain Syndromes and Its Pain Management** 208
Dwarkadas K Baheti

SECTION 6: UROGENITAL AND PELVIC PAIN

25. **Nonmalignant Urogenital Pain Management** 217
Ashish Gulve, John Hughes

26. **Chronic Nonmalignant Pelvic Pain** 233
Kyriacos Kyriakides

SECTION 7: CANCER PAIN

27. **Head and Neck Cancer Pain Management** 241
Manohar L Sharma

28. Breast Cancer: Pain and Its Management **248**
PN Jain

29. Carcinoma Lung: Pain and Its Management **252**
Arun K Bhaskar

30. Upper Abdominal Malignancy: Pain and Its Management **264**
Dwarkadas K Baheti

31. Malignant Pelvic Pain and Its Management **270**
Subhash Jain

32. Metastatic Bone Pain Management **281**
Raghbir Singh P Gehdoo, Jasmeen Kaur

SECTION 8: NEUROPATHIC PAIN

33. Neuropathic Pain: Approach, Pathophysiology, and Management **297**
Satish V Khadilkar, Abhinay M Huchche, Nahush P Dilip, Madhu B Singla

SECTION 9: ISCHEMIC PAIN

34. Peripheral Vascular Disease: Causes and Pain Management **309**
Kailash M Kothari

SECTION 10: MYOFASCIAL PAIN

35. Management of Myofascial Pain **323**
Kritika M Doshi

36. Fibromyalgia: Causes and Pain Management **332**
Muralidhar Joshi

SECTION 11: SCAR PAIN

37. Post-herniorrhaphy Pain and Its Management **341**
Lakshmi C Vas

38. Post-coronary Artery Bypass Grafting Scar Pain and Its Management **353**
Madhuri A Lokapur

SECTION 12: CHALLENGING PAIN

39. Complex Regional Pain Syndrome: Where We Stand? **359**
Samyadev Datta

40. Phantom Limb Pain: Causes and Pain Management **372**
JD Hoppenfeld

41. Postherpetic Neuralgia: Causes and Pain Management **377**
Charles Daknis

42. Post-laminectomy Pain and Its Management **383**
Preeti P Doshi

43. Restless Leg Syndrome: Causes and Pain Management **395**
Dwarkadas K Baheti

44. Calciphylaxis and Its Pain Management **400**
Krishna Poddar

45. Regenerative Medicine for Spine and Orthopedic Conditions **407**
Annu Navani, Joshua D Chrystal

SECTION 13: PHYSIOTHERAPY

46. Role of Physiotherapy in Treatment of Patients with Spinal Pain During the Acute/Inflammatory Phase **423**
Rob Naber

47. Role of Physiotherapy in Treatment of Spinal Pain During Subacute/Reparative Phase **437**
Neeraj D Baheti

48. Physiotherapy in Management of Chronic Pain **448**
Saroj M Sanghavi, Dakshesh M Sanghavi

SECTION 14: PSYCHIATRY

49. Role of Psychiatric Medications in Chronic Pain Management **459**
Harish K Shetty, Surbhi C Trivedi

50. Pain Psychology and Its Treatment Options **463**
Anjali M Chhabria, Shrradha V Sidhwani, Juhi J Parmar

SECTION 15: ALLIED THERAPY

51. Role of Radiation in Cancer Pain **473**
Krishna A Balkundi, Pallavi B Patil

52. Role of Chemotherapy in Cancer Pain Management **478**
Ashish V Bakshi, Nilesh M Lokeshwar, Vibhay Pareek

53. Oncosurgery and Cancer Associated Pain **485**
Deepak Chabbra

54. Management of Ophthalmic Pain **491**
Salil A Mehta

Index ***499***

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4

CHAPTER

Chronic Pain

Neel Mehta, Timothy Connolly

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DEFINITION

While acute nociceptive pain serves as a biologically necessary marker of inflamed or damaged tissue, chronic pain fails to serve physiologic purpose and can be thus defined as overwhelmingly pathologic in nature. Chronic pain is devoid of the innate adaptive and protective functions intrinsic to acute pain. The underlying pathology, if accompanying the symptomatic chronic pain patient, frequently cannot fully explain the presence nor severity of the patient's pain.

Chronic pain is a multifaceted disorder comprised of physical, psychological, and social components. The extensive variability in symptoms and severity compounds the difficulty in the therapeutic approach. Chronic pain has been defined in contemporary literature as unresolving pain lasting for a period of time longer than 3 to 6 months.[1-3] A more encompassing definition, presented by Merskey had defined chronic pain as simply that which persists beyond the duration of underlying tissue damage.[4] The benefit gained by the latter definition is in bypassing the dilemma of holding a largely variable disease process to such objective temporal constraints. The definition presented by the American Society of Anesthesiologists (ASA) analogously follows Merskey in citing chronic pain to be "beyond the expected temporal boundary of tissue injury and normal healing, and adversely affecting the function or well-being of the individual".[5]

The impediment to descriptions intentionally devoid of explicit time constraints lies in the determination of when it becomes appropriate to address the afflicted patient as suffering from chronic pain. The distinction between acute and chronic pain has no clear watershed moment, and it is this ambiguity that compounds on the therapeutic challenge. The evolution of acute into chronic pain is complex with both physiologic, psychological and social aspects. The elusive nature of pain lies within the fact that it's perceived quality and severity is influenced by the context in which it is experienced.

A painful stimulus interferes with the patient's conscious thought processes, evolutionarily designed to draw focus towards a perceived threat to the individual's well-being. While serving a beneficial adaptive purpose in the acute state, the psychological, social and behavioral consequences of such perpetual cognitive interference can lead to detrimental outcomes for the suffering patient. The impact of the patient's condition can take a substantial toll on not only their well-being, but on their

emotional health, profession, and personal relationships. The challenges of chronic pain translate correspondingly to the practitioner, with requirements similar to any chronic disease such as diabetes and congestive heart failure. This may include resource intense treatments, a need for further guidelines and algorithms, and a variety of ailments.

Chronic pain can be involveereliance on the patient's given description of their pain, owing to the personal and subjective experiences of their affliction. Chronic pain is distinctive from most all other disease processes in it's multicomponent nature. In addition to the principal sensory and discriminative component, localizing location and severity, there will often be affixed affective, emotional and even cognitive elements. Thus unequivocal terminology is a necessity to best determine the likely etiology and most efficacious path for treatment. As seen in the acute pain chapter, there are several overlapping features and decscriptors.

- Nociceptive pain: Pain attributable to trauma or noxious stimuli. Physiologic in nature
- Neuropathic pain: Pathologic constitution. pain due to prior nerve injury, thought secondary to peripheral and central reorganization
- Inflammatory pain: Pain attributable to tissue injury without neural component. Can be categorized as physiologic or pathologic
- Allodynia: Pain secondary to a stimulus containing no intrinsic painful properties
- Hyperalgesia: Disproportionately elevated perception of pain in response to a noxious stimulus.

PREVALENCE

Chronic pain is one of the most common healthcare afflictions, affecting anywhere between 20 and 37% of the world's population.[6] The Institute of Medicine (IOM) estimates the prevalence of chronic pain conditions to afflict more than 116 million individuals within the United States alone, and constitutes a patient population larger than cardiac disease, cancer and diabetes combined.[7] The etiologies of specific ailments attributed to these chronic pain conditions were largely musculoskeletal pain, with low back pain comprising the most common identifiable cause. According to a 2008 National Health and Nutrition Examination Survey (NHANES), the estimated prevalence of back pain within the population was 10.1%. This was followed by pain localized to the lower extremities, affecting 7.1% of patients, the upper extremities (4.1%), and lastly by those with pain due to headaches (3.5%).[8] About 19% of adults in the United States report persistent pain throughout their daily lives,[9] with more than 126 million US adults afflicted by a pain condition within the past 3 months.[10]

Epidemiological studies into the prevalence and trends of chronic pain provide necessary data to begin to formulate the appropriate treatment modalities for these patients. This is important in not only understanding the etiology of chronic pain patients within the developed world, but the developing world as well. The Global Burden of Disease Study compiled data on global injuries and diseases for 188 countries between 1990 and 2013, utilizing the metric of years lived with disability (YLDs). Chronic pain conditions comprised half of the top 10 leading causes of global YLDs, with marked consistency noted across most all nations. Lower back pain was found to be the overwhelmingly preeminent contributor, with over 72 million YLDs attributed.[11] Lower back pain was found to be the leading cause of YLDs in 86 of the 188 nations, and either the second or third leading cause for an additional 61 countries. Over 34 million YLDs were as a result of neck pain, nearly 29 million YLDs due to chronic migraines, and 22.6 million YLDs caused by chronic musculoskeletal pain secondary to disorders such as shoulder pain, hip, and joint disease, as well as arthritis. These conditions often affect women more than

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men, with an increasing prevalence for both genders seen with increasing age appreciated in the literature

However, there are limitations with these studies.

These studies are often faced with the difficult task of a multitude of confounders. Chronic pain is known to have an increasing prevalence within the population as age increases, however, proper evaluation of the true etiology of pain becomes difficult with the concomitantly rising incidence of multimorbidity in this age group. Whereas moderate to severe pain has been found to only affect approximately 5% of children and adolescents, up to 44% patients 65 years of age and greater are afflicted by some form of chronic pain.[12,13] The difficulty becomes in appropriately addressing the primary cause of the chronic pain in the setting of additional effects of disease interactions.

ECONOMICS

The economic impact of patients with chronic pain conditions constitute a significant cost to the healthcare system as a whole. In the United States, the annual cost of treating conditions rooted in pain has been found to be higher than heart disease, cancer and diabetes.[14] In an analysis of more than 20,000 individuals between 2008 to 2010 the IOM found the mean yearly health care spending on patients with severe pain to be nearly $9,000 more than for those without pain. The direct healthcare costs related to pain conditions were found to be between $261 and $300 billion annually.[15] The substantial impact of direct costs to the pain patient and healthcare system are significantly augmented when accounting for factors that consider the harm done to the productivity of the individual. The estimated losses due to days of work missed ranges between $11.6 and $12.7 billion. Up to $96.5 billion is lost due to individual hours of lost productivity, and between $190.6 and $226.3 billion attributed to a compensatory decline in wages. When accounting for the whole fiscal scope impacted by chronic pain, the estimated healthcare cost within the United States alone can range from $560 to $635 billion.[16]

Pain conditions are one of the most common afflictions resulting in lost productive time and work hours. Data from the American Productivity Audit estimates a loss of over $61 billion each year due to lost productive time from pain-associated conditions, accounting for 12.7% of individuals comprising the United State workforce.[17] The impact on the workforce and increasing economic consequences pose a significant public health challenge. Recent years continue to show the demographic proportion of older adults within the global population progressively increasing in most all nations. The continued rise in an aging population come following a multitude of advancements in healthcare and comprehensive gains in life expectancy.[18] This can lead to increasing costs for something as common as low back pain, P with decreased compensation for affected patients.[19] Furthermore, Iit is estimated that up to 20% of all primary care visits are secondary to pain conditions.[20]

CLASSIFICATION

Establishing a taxonomy to best classify the array of disorders that comprise chronic pain is intrinsic to the proper evaluation of the patient. A comprehensive model for diagnosis will optimize the understanding of the disorder and lay the necessary groundwork towards the path of optimal treatment. Constructing a model to accurately diagnose between related disorders is an established and familiar concept within the medical field, yet the multifaceted nature of chronic pain has separated it from other fields. Restrictive "cause-and-effect" models of diagnosis are essential to the many disorders that require identification of a solitary etiology, yet cannot successfully capture disease states with such multitudinal origins.

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Chronic pain is traditionally preceded with the qualifying description of malignant or nonmalignant pain. Pain secondary to cancerous origins more accurately represents an ongoing collection of nociceptive stimuli, classically more analogous to acute pain than chronic pain. Chronic pain due to noncancerous origins is more aptly described in this sense, as the converse term "benign" chronic pain beguiles a misleading and incorrect terminology in describing the potentially debilitating conditions that fall within its domain.

While there are several methods of categorizing chronic pain from noncancerous origins, an encompassing classification consists of chronic pain due to inflammation, musculoskeletal pain, neuropathic pain, chronic headache pain, and chronic recurrent pain. The latter comprises chronically resurgent pain secondary to acute injury to tissue, such as osteoarthritis and sickle cell disease.

The current framework for chronic pain conditions, as according to the International Association for the Study of pain (IASP), has grouped the multiple etiologies of pain conditions into seven separate categories. These include chronic musculoskeletal pain, chronic visceral pain, chronic headache and orofacial pain, chronic posttraumatic and postsurgical pain, neuropathic pain, cancer pain, and chronic primary pain. The IASP has successfully collaborated with the World Health Organization (WHO) and begun the integration of this subcategorization of chronic pain conditions into the 11th revision of the WHO's International Classification of Diseases (ICD-11).[21] The IASP task force has placed forth a classification system of coding chronic pain as a distinct diagnosis in itself. The new ICD category for chronic pain as a panoptic heading for its family of disease is subcategorized by perceived anatomic location, etiology, or affected system. Each of the seven categories are built upon content models in the description of the clinical characteristics of their respective branch of chronic pain conditions, with inclusion for psychosocial factors as well as number of modifiable variables to constitute pain quality and severity. This approach significantly improves the approach to chronic pain conditions, in that it is recognized as the distinct clinical disease process it is, rather than the outcome or result of other clinical conditions.

CAUSES

While the detailed explanation of each of the chronic pain conditions is beyond this chapter and is gone into more detail elsewhere in this book, it is useful to broadly mention and categorize the causes as follows:

- Anatomic
  - Headache
  - Craniofacial
  - Neck and upper extremity
  - Lower back pain
  - Abdominopelvic
  - Lower extremity pain
- Widespread/neuropathic
  - Fibromyalgia
  - Complex regional pain syndrome
  - Diabetic neuropathy
  - Post-stroke
  - Spinal cord injury
  - Multiple sclerosis
- Cancer.

ETIOLOGY

The acute pain pathway evolved as a protective biologic mechanism in order to identify real or potential tissue damage an injury. Peripheral nociceptive fibers, when triggered by a noxious stimulus, will send afferent signals towards the spinal cord, where they synapse within the dorsal horn. The afferent peripheral fibers consist of myelinated A-delta fibers, which constitute the rapid, sharp initial pain sensed by the individual, as well as unmyelinated C-fibers, mediating the slow burning pain

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persisting at the site of original injury. The afferent impulse travels the ascending projections of the anterior portion of the spinothalamic tract (STT) following synapse with respective neurons in lamina IV-V. Once projected to the second order neurons, the impulse ascends after crossing midline at the anterior white commissure. Second order neurons then project the impulse into the thalamus.

It is important to note that normal physiology of transmitting input from peripheral nociceptors to second order neurons Is mediated by cellular depolarization resulting in an action potential propagating towards the higher order neural pathways. These synaptic transmissions propagated between nociceptors and dorsal horn neurons serve a physiological function to protect from an identified noxious stimulus with eventual return to a set baseline. Continued or prolonged excitation of peripheral nociceptors can permit for a pathologic increase in subsequent output and for a markedly longer window of time the individual will be afflicted by the original insult.

A novel approach to the concept depicting the means by which sensory information is processed at the spinal cord was first proposed in 1965 by Ronald Melzack and Patrick Wall.[22] They postulated a gate-control theory as a means of describing a physiological mechanism by which psychological factors could mediate the perception of pain. They described a model in which all pain signals and information must pass through a "gate" in or near the substantia gelatinosa if the spinal cord in which only particular impulses would be allowed to transmit to the brain. This would, in turn, relay transmission of pain signals to the brainstem and cerebral cortex. This narrow gate, therefore, would be one that can open and close, thereby modulating the sensation of pain. They described pain, therefore, to not simply be a direct result of activation of receptor neurons, but rather a modulated perception through interactions amongst different neurons. In the absence of a noxious stimulus, inhibitory interneurons sit at the substantia gelatinosa blocking activation of projection neurons connecting to the brain. With a painful stimulus, signals carried by the peripheral afferent A-delta and C fibers will activate projection neurons connecting to the brain, as well as inhibit the attempt of inhibitory cells to block the output of the projection neuron that connects with the brain, thus "opening" the gate. Peripheral pain is then successfully transmitted to the spinal cord, hypothalamus, and cerebral cortex. Conversely, however, collateral projections from proprioceptive myelinated fibers will activate the inhibitory cells, leading to subsequent inhibition of noxious signal transmission. This mode of transmission thus closes the gate and limits pain stimuli from reaching the higher nervous system centers. This theory can be appreciated clinically with appreciable lessening of pain following the application of pressure over a site of acute injury.

Melzack and Wall additionally postulated the important concept of similar gating mechanism within nerve fibers originating from the thalamus and cortex and transmitted to the descending spinal tracts. Influence from cerebral and brainstem centers regulating concept and emotion can thus influence the intensity and volume of pain signals. The inhibitory effects of these impulses originate principally from periaqueductal grey matter (PAG) within the midbrain and raphe nucleus magnus (RNM) of the medulla. Neurotransmitters released from these sites produce activation of the inhibitory interneurons within the substantia gelatinosa, and thus reduce the transmission of pain. The perceptual notion of pain is, therefore, best conceptualized by not merely a transmission of a noxious stimulus, but a dynamic modulation depending on the individual's cognitive and emotional

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experience. Analogous to the functional alterations and neuroplastic changes seen of sensitized peripheral nociceptors, plasticity and "central sensitization" of the higher order nervous system with corresponding functional alterations in clinical pain modulation is an intrinsic perpetrator to many chronic pain disorders.[23]

While the role of plasticity in the reorganization of neural function has been long established, only recently have we been able to demonstrate a corresponding effect in the reorganization of neural structure. The rapid technological advances of recent years has provided innovative advancements in the approach to understanding the pathophysiology of chronic pain.

Recently, functional magnetic resonance imaging (fMRI) has shown chronic clinical pain conditions are often associated with decreased baseline activity or decreased stimulus related activity in the thalamus.[24] These studies have demonstrated patterns of altered brain function and neurochemistry[25] with the potential to not only identify markers and sequences of chronic pain but another approach for treatment.

SOCIAL AND PSYCHOLOGICAL IMPACT

The psychological effects of pain are well known to all individuals afflicted by an acute painful experience during the course of their lives. The predominating focus of the mind becomes engrossed by the foci of pain, detracting away from work, family, friends and interests. The return to a normal state of being intrinsically depends on the resolution of the painful stimulus over time. Patients suffering from pain devoid of such resolution will consequently and almost inevitably suffer a similarly prolonged course of social and psychological harms. The persistence of pain is wrought with changes in personality; distress from prolonged suffering results largely in a predictable withdrawal and depression with lapses in previously held personal goals and responsibilities. It is paramount for the practitioner to appreciate the multifaceted nature of chronic pain, with cognizance given to the interdependent fibers required for the generation of chronic pain.

There has been a progressive evolution over the past several decades in creating the modern comprehensive model of chronic pain. The traditional biomedical model of health, derived from Louis Pasteur's germ theory, conceptualizes illness as purely biologic factors devoid of environmental, psychological, or social components. While the biomedical model has demonstrated great efficacy in the diagnosis and treatment of innumerous disease processes, such a restrictive model has failed to fully depict the domain of chronic pain. The absence of an algorithmic structure predictively demonstrating clear cause-and-effect pathology obligates a multimodal approach in modeling this disease.

Pain is both variable and modifiable, not only by medical or physical interventions, but by the patients themselves. The cognitive and emotional impact of pain on the individual heavily dictates the severity of its subjective nature. Even before the turn of the 20th century, Sir William Osler advocated physicians to "...care more particularly for the individual patient than for the special features of the disease."[26] Similar nociceptive stimuli will yield markedly variable perceived attributes of pain depending on the individual, their culture, and personal experiences. It is important to identify and understand the separate entities of nociceptive stimuli and the perception of pain. There is a remarkably vast gradient in the correlation between these two values. The development of chronic pain leads to a continual focalization of the mind towards the perceived noxious stimulus. The predominant majority of the patient's consciousness is unremittingly centralized around the painful sensation.

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Patients attach meaning to pain, the variable nature of which will greatly influence the degree and quality of their expressed pain.

Patients with chronic pain who report to their primary care vs those who seek out pain specialists may have starkly different perceptions of both their level of distress and perceived severity of their illness.

This pain can lead to a cycle of psychological attributes which can feed into a cycle of perceived pain. The treatment should focus of directing the patient to focus on gaining "better control" of pain, encouraging "manageable pain" rather than feeding into cycle of failed treatments that lack ability to cure multifaceted roots.

CONCLUSION

Much work needs to be done to further research understanding of causes and treatment of chronic pain. Physicians must address patients of the current world, with many presenting already marred by attempts at self-education or self-diagnoses that have become exponentially available through virtual libraries and online communities.

These include use of proper education and explanations as a tool to ease any of these anxieties or psychologic factors augmenting their perceived pain.

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- A comprehensive and practical book inclusive of various types of pains concerning the individuals as well the treating physicians
- The book has been divided into sections covering basics, clinical examination and evaluation, cervical and neck pain, low back pain, urogenital and pelvic pain, and cancer, neuropathic, ischemic, myofascial, scar, and challenging pains
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Dwarkadas K Baheti MD
Consultant Anesthesiologist and Pain Physician
Bombay, Lilavati, Shushrusha, and Raheja Hospitals
Mumbai, Maharashtra, India



Sanjay Bakshi MD
President
Manhattan Spine and Pain Medicine
New York, New York, United States



Sanjeeva Gupta MBBS MD DNB
FRCA FIPP FFPMRCA
Consultant in Pain Medicine
Bradford Teaching Hospitals NHS Foundation Trust
Spire Leeds Hospital, Nuffield Hospital Leeds
United Kingdom



Raghbir Singh P Gehdoo MD DA
Professor
Department of Anesthesia
Tata Memorial Hospital
Mumbai, Maharashtra, India

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