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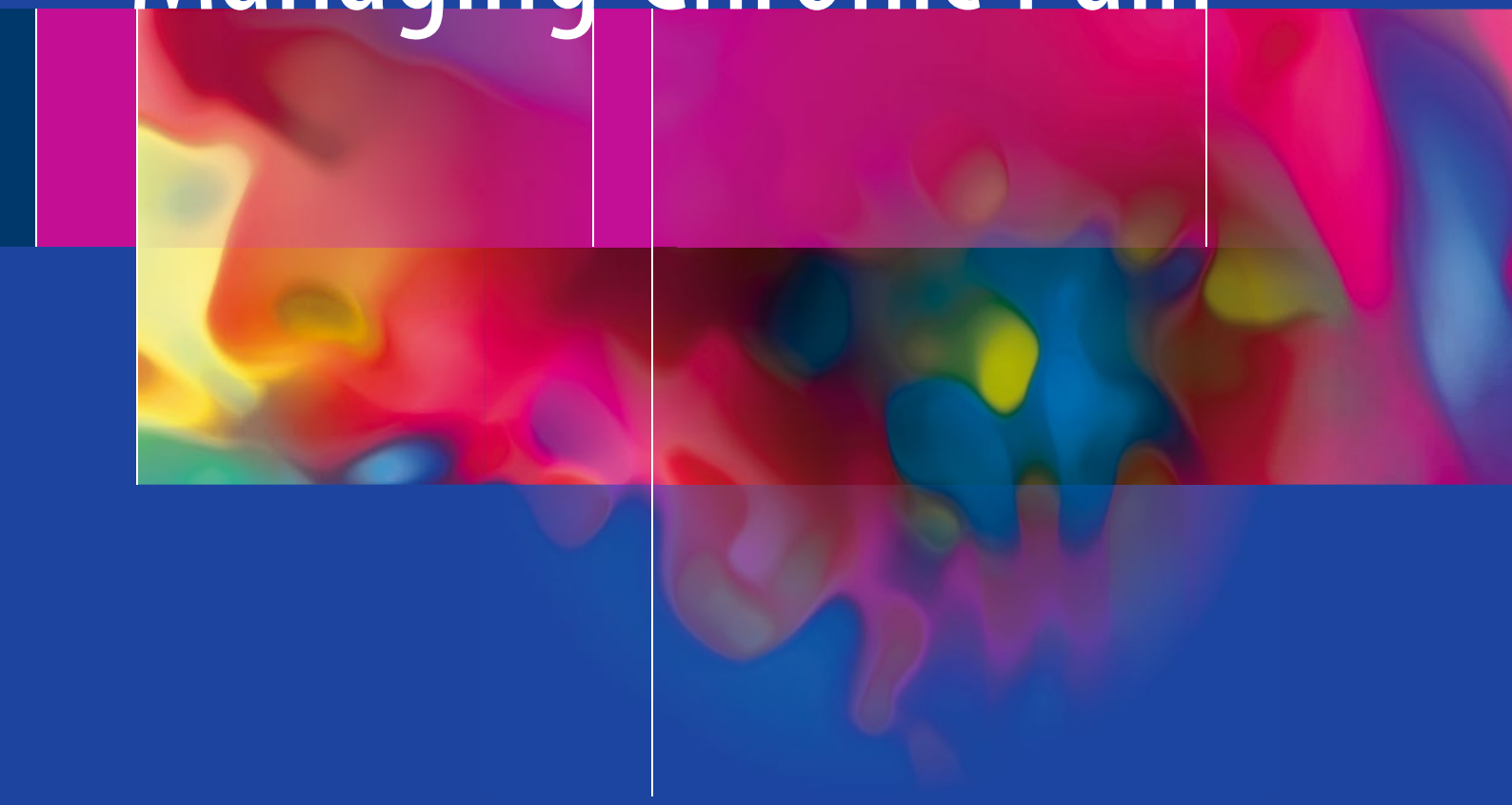
Essentials of Interventional Techniques in Managing Chronic Pain



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Foreword

Drs. Laxmaiah Manchikanti, Alan D. Kaye, Frank J.E. Falco, and Joshua A. Hirsch, all internationally renowned interventional pain physicians, have written *Essentials of Interventional Techniques in Managing Chronic Pain*. They have devoted most of their lives to improving the pain management of patients globally. I am honored to write a Foreword for this monumental undertaking.

To emphasize the importance of this book, I need to reiterate the definitions, statistics, and the multiple modalities of treatments available to us for treating chronic pain today and their potential adverse consequences. Chronic pain exists globally. The prevalence of chronic, persistent, disabling pain seems to be increasing with low back pain, neck pain, and other musculoskeletal disorders occupying the top five categories of disability with escalating costs, and numerous modalities of treatments ranging from over-the-counter acetaminophen to complex surgical fusions [1–12]. In addition to the costs and health economy impact, there are multiple issues related to diagnostic accuracy and therapeutic efficacy, as well as numerous complications related to these therapies with almost over 16,000 deaths due to opioid poisoning in 2012, an increase of 300% since 1999 [8, 13]. Methadone alone contributed to 4418 deaths in 2011 [13], and there were over 8000 unintentional drug poisoning deaths from heroin in 2013, a 39% increase from 2012, and nearly doubling the 4400 deaths in 2011 [13].

Acetaminophen has been implicated in 1000 deaths a year [14]. Nonsteroidal antiinflammatory drugs (NSAIDs) have been reported to be responsible for almost 17,000 deaths with numerous gastrointestinal complications [9]. Spinal surgical fusions caused over 1000 deaths in 2008 [7]. Sadly, all modalities of treatments are increasing rapidly with evidence lacking for many of them. There are also numerous considerations, explosive use and safety, including the interventional techniques that are the subject of this book [11, 15, 16]. While accurate data is available in the United States and other developed countries, in many countries pain may be undertreated and have a higher prevalence than thought; these people may be unable to enjoy the benefits of new advances in interventional pain management.

Chronic pain is a complex and multidimensional problem. Chronic pain is defined as pain that persists 6 months after an injury and beyond the usual course of an acute disease or a reasonable time for a comparable injury to heal; is associated with chronic pathologic processes that cause continuous or intermittent pain for months or years that may continue in the presence or absence of demonstrable pathologies; may not be amenable to routine pain control methods; and healing may never occur [17]. Interventional pain management is defined as the discipline of medicine devoted to the diagnosis and treatment of pain-related disorders principally with the application of interventional techniques in managing subacute, chronic, persistent, and intractable pain, independently or in conjunction with other modalities of treatment [17]. Similarly, interventional techniques have been defined as minimally invasive procedures, including percutaneous precision needle placement, with placement of drugs in targeted areas or ablation of targeted nerves; and some surgical techniques such as laser or endoscopic discectomy, intrathecal infusion pumps, and spinal cord stimulators for the diagnosis and management of chronic, persistent, or intractable pain [17]. Interventional pain management's origins go back to 1884 with neural blockade and regional analgesia [18]. Since then, regional anesthesia and interventional techniques have evolved by leaps and bounds, now reaching

numerous claims of overuse, abuse, and fraud [17, 19]. Consequently, due to the changing dynamics of interventional pain management with the explosive increase in interventional techniques, accountable interventional pain management, and value-based practice, the performance of evidence-based, cost-effective, and clinically effective techniques are coming into play, which are enlightened in this book [17, 19].

Pain practice today is fortunate to have many physicians making this practice a professional part of their career. They come from all specialties, and education now has to reflect the advances pain practice has made in all those specialties, not just those in anesthesiology.

The challenge today is to train pain physicians in such a way that they have a standardized curriculum during their residency and pain fellowship programs, followed by skilled practical training in anesthesiology, neurosurgery, physical medicine and rehabilitation, or psychiatry. Once trained, they need to be examined and tested periodically for their competency. This will raise the standard of pain practice, not only in the United States, but all over the world. Evidence-based medicine or evidence-based practice aims to apply the best available evidence gained from scientific methods to clinical decision-making [17, 18]. It seeks to assess the strength of evidence of the risks and benefits of treatments (including lack of treatment) and diagnostic tests. Evidence quality can range from meta-analyses and systematic reviews of double-blind, placebo-controlled clinical trials at the top end, down to conventional wisdom at the bottom. However, in the modern era, even with the development of comparative effectiveness research with numerous changes in health care philosophy, and without involvement of clinicians, evidence-based medicine has been minimized with overwhelming conflicts of interest, inappropriate analysis and lack of application of the principles of evidence-based medicine, focusing more on cost savings and policy decisions rather than evidence itself .

This book, *Essentials of Interventional Techniques in Managing Chronic Pain,* fills the void where literature should conform to local necessities for information to be useful in that society. The format of the book is excellent; each chapter is consistent in describing an interventional technique in simple terms from history to complications and efficacy, stressing at all times technique and safety, encompassing evidence-based, cost effective, and value-based practice.

Essentials of Interventional Techniques in Managing Chronic Pain accomplishes the ambitious goal of directly addressing the field writ large.

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Foreword

Interventional Pain Management (IPM) is effective when it is practiced as intended and when there is an understanding of pain-triggering mechanisms. IPM's foundation comes from clinical and basic science research and publications. What is known about IPM has been widely reported in multiple books, articles, and journals; however, a lot of them have not covered all aspects of IPM. The authors of this book have been key figures in the evolution of IPM and the American Society of Interventional Pain Physicians (ASIPP). They deserve our gratitude for their major effort in making this book, *The Essentials of Interventional Techniques in Managing Chronic Pain*, possible. The editors, Drs. Laxmaiah Manchikanti, Alan D. Kaye, Frank J.E. Falco, and Joshua A. Hirsch, have taken on a challenge that future readers will appreciate.

It is evident that the intent is to present a body of work that includes evidence, outcomes, and basic and clinical research in the best interest of the patients that we all serve, as well as for providers of the best possible care. Complications and medico-legal consequences are not touched upon in a comprehensive manner because of the nature of the information. Looking at avoidable complications, one cannot rely upon one person's experience alone. One experience tends to be just one opinion regarding a low frequency of recurring complications. One physician may go through a lifetime of practicing without complications, and another physician may have two or more disasters in a short period of time. The field has very little evidence regarding complications from so-called evidence-based studies; rather it comes from poorly collected and published medico-legal and clinical experiences.

The cost-effectiveness of IPM is favored when it is done appropriately, rather than when it is done because that is the only way that the practitioner approaches the problems of patients seeking help. Treatment algorithms continually need to be updated as new therapeutic interventions and convincing evidence surfaces. Evaluating evidence is a peer-reviewed process and it is not an insurance company's God-given right to deny therapy without compelling negative evidence. Some clinical studies may take 5–6 years from the preliminary data gathering to the conclusive multi-center prospective randomized double-blind placebo-controlled trials [1].

The contributors have accepted responsibility for their part of presenting the material, as it has become an essential component of IPM as a distinct medical specialty. ASIPP has grown and matured since its founding in 1998 from a handful of leaders under the relentless leadership of Laxmaiah Manchikanti and numerous individuals that have grown professionally and contributed their time and effort freely. There has not been a vested interest as a reason for the above, except the obvious love of the specialty.

The contributors to this book have been chosen for their experience and knowledge of the field. The book is well structured. It represents and recognizes a long journey from John Bonica's first major effort of a similar-sized book entitled, *The Management of Pain* [2]. The current book reflects much more pathophysiology, principles, new technologies, and pain-related interventions. The reader appreciates more neurosurgical type principles that go back to the pragmatic approaches of Harvey Cushing. Cushing recognized major reasons for neurosurgery and operating on the brain because of the development of local anesthesia and radiofrequency thermocoagulation. Cushing also made a comment that a good neurosurgeon is a

good traveler. What he was implying was for a neurosurgeon to learn, go in, and visit those that were known to be excellent at whatever they were doing. Similarly, we can say that a good IPM physician attends many conferences, reads many articles, and reviews many other modern therapeutic educational opportunities to improve their safety and efficacy for providing care to their patients [3].

Throughout the book, the significance of evidence that comes from publications is evident. One has to remember that the evidence gathered is only as clinically relevant and valid as the question posed to gather the evidence. Studies may look statistically significant and be published in a highly rated journal, only to realize years later that the foundation of the study was flawed. Such an example is a study by Kemler et al., published in *The New England Journal of Medicine* on the usefulness of neuromodulation in upper extremity complex regional pain syndrome 1 (CRPS 1), as compared to conservative therapies [4]. Five years later, in a Letter to the Editor, the authors commented that there was no difference in the two therapies. However, every study subject had a surgical thoracic sympathectomy and not a single one of them returned to work. The study, after the fact, made it appear that neuromodulation is no better than conservative therapy, rather than the fact that individuals conducting the study did not know how to treat CRPS 1 [4]. Appropriate use of neuromodulation in treatment of upper extremity CRPS 1, published in *Neurosurgical Treatment of Pain* [5, 6], showed over 50% returned to work and had many years of effectiveness from the use of neuromodulation in spinal cord and peripheral nerve stimulation.

The current book reflects the turning tide against the overuse of opioids and the increasing death rate from prescription use, abuse, and diversion. This restriction should be followed by a reduction in mortality figures; however, one has to remember that medications are needed, and if they are restricted, appropriately carried out IPM procedures will lead to a much improved quality of life in our patients. The perceived morbidity and mortality from IPM procedures are low; however, not acceptable. The incidence of complications is similar to anesthesiology mortality statistics in the 1960–1970s, when it was 1 in 10,700. Because of the Anesthesia Patient Safety Foundation's recommendation of using improved monitoring with pulse oximetry, carbon dioxide, and oxygen monitoring and alarms, mortality has been reduced 20-fold.

So far, in the medico-legal arena, every single complication from cervical, lumbar, thoracic, and transforaminal injections has been from a sharp needle intraneural and/or intra-arterial injection of local anesthetics, plus particulate steroids in the case of arteries. Blunt needle use is increasing worldwide but has not gained acceptance as the evidence would dictate. The incidence appears to be similar to the anesthesiology mortality rates before the Anesthesia Patient Safety Foundation's recommendations.

It is surprising that even major studies have virtually no recognizable incidence of complications. New therapeutic modalities are coming, and with them, complications will follow. A previous example is the heat lesioning of discs without the ability to determine a safe location for the lesioning electrode within the disc (IDET). The device had no motor stimulation capability, and inadvertently a misplaced intraspinal cannula electrode caused paralysis from the burning of the cauda equina. Simple motor stimulation prior to lesioning would have revealed proximity to the nerves.

A new evolving field is the use of ultrasound guidance for regional anesthesia. The field is also expanding into chronic non-spinal pain procedures. The field of chronic pain medicine has grown dramatically in a different direction from ultrasound. Up-to-date experience, inappropriate needle placement, and injection complications will follow as the use of ultrasound increases. Such examples include brachial plexopathy from interscalene injections. Also, the preoccupation for looking for targeted nerves and avoiding arteries has led to overlooking the proximity of the level of the injection. In a practice that has never seen a pneumothorax from an interscalene block, there have been two cases of pneumothoraces following ultrasound-guided procedures. The level of injection was overlooked.

The most impressive aspect of this book is the vision of Laxmaiah Manchikanti for working with an impressive group of pain physicians in gathering all this information into one location.

Nevertheless, it is also important for each practitioner to build a network of respected colleagues and practitioners within the same field so they can turn to them for the best advice, especially in times of need.

Neuromodulation came from humble beginnings and has blossomed with ever-improving technology. The procedure has grown unnecessarily complex and expensive but technology is also keeping up with the need for complex pain problems such as the recent successful US trial for high-frequency stimulation matching European outcome data. Even more exciting is minimizing the use of equipment with micro technology where a battery is not implanted. The receiver is so small that it is implanted within the electrode. Hopefully the outcome will exceed patient and practitioner expectations with fewer complications, better outcomes, and reduced costs.

I strongly recommend this book. As one that has visited many homes of physicians that I have trained, instead of finding hungry young doctors eager to learn, nowadays I am finding experienced, respected, graying-haired physicians who are looking forward to going to work the next day. As each day brings new challenges, these challenges demand them to have an up-to-date library and *The Essentials of Interventional Techniques in Managing Chronic Pain* belongs there.

Lubbock, TX, USA Gabor B. Racz

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Preface

During the course of our training and practice, the dynamics of what we today call interventional pain management have changed from simple bedside injections to a full-fledged specialty with its own specialty designation (−09), explicit definition of interventional techniques, and mandated representation on the Centers for Medicare and Medicaid Services (CMS) Carrier Advisory Committee (CAC). Since the formation of the American Society of Interventional Pain Physicians in 1998, there has been a dramatic increase in publications showing scientific basis, effectiveness, and cost utility analysis. However, this fledging specialty has faced and continues to face multiple hurdles, ranging from inappropriate application of interventional techniques to abuse patterns and escalating growth patterns without demonstrated efficacy for some procedures and settings, and a convergence of regulations and policy making.

Interventional pain management is an evolving and dynamic specialty with a history dating back to 1901, with descriptions of epidural injections in managing pain. Today, a large body of literature has evolved related to the use of interventional techniques for the management of chronic pain. Even though there are numerous publications available for a clinician to reference, some texts have focused mostly on the technical aspects, whereas others have focused on the theoretical aspects without providing appropriate succinct information. Raj's *Practical Management of Pain,* with its multiple editions since 1986, has provided readers with a great resource for the study of pain. However, until the publication of *Interventional Techniques in Chronic Spinal Pain* and *Interventional Techniques in Chronic Non-Spinal Pain* by the present authors, there has not been a quick reference to the clinical and technical aspects of interventional techniques in the modern era. In 2007 and 2009 the American Society of Interventional Pain Physicians published two separate books describing interventional techniques in chronic pain. This ambitious project, undertaken by the editors and the American Society of Interventional Pain Physicians, exceeded everyone's expectations.

Interventional Techniques in Chronic Spinal Pain and *Interventional Techniques in Chronic Non-Spinal Pain* have provided a comprehensive approach with intellectual and practical coverage describing the appropriate role of interventional techniques in chronic pain management, but as the literature has evolved, some of the concepts have been changed and others have become outdated. Consequently, on behalf of the American Society of Interventional Pain Physicians, we, the editors of this publication, have undertaken the task of revising and updating our previous publications, resulting in an entirely new publication with comprehensive, evidence-based, practical coverage of the specialty, while keeping the original intent of providing a clinician with technical information.

With this encyclopedic work, covering the entire field of interventional pain management with a special focus on technical aspects, we have attempted to provide a comprehensive understanding without being cumbersome or long. From across the nation, leading experts in their respective fields have contributed chapters on specific topics following a single format to present a cogent and integrative understanding of the field of interventional pain management.

We have maintained the overall unique structure of the previous publications with an introduction of the subject, historical background, pathophysiology, evidence base, indications,

anatomy, technical aspects, side effects and complications, precautions, and synoptic key points for each topic when available and applicable. This book consists of 46 chapters, 932 figures, and 87 tables under the major sections of Basic Considerations, Spinal Interventional Techniques, Non-Spinal and Peripheral Nerve Blocks, Sympathetic Interventional Techniques, Soft Tissue and Joint Injections, and Implantables.

The administrative and logistic exercise of developing this monumental task in the form of a publication and bringing it to the final stage has placed considerable responsibilities and demands on the editors, their families, the staff of the American Society of Interventional Pain Physicians, and finally, the staff of Springer International Publishing. The editors wish to thank all of the players involved from development to publication for their time, efforts, and devotion. Apart from the editors, contributors, and publishers, significant efforts were afforded by Tonie Hatton, Diane Neihoff, Holly Long, and Vidyasagar Pampati, MSc. In addition, many others deserve mention and thanks including radiological technologists, Kimberly Cash and Marilee Johnson, for their contributions in providing high quality fluoroscopic images. We are also indebted to many of the world leaders in interventional pain management and our families without whose guidance and patience, this work would have never been completed.

Even though this is an entirely different text, it is a work in progress as a second edition. The overall focus continues to be patient safety and interventional therapies to reduce pain and suffering. We continue to hope that this book maintains practicality and durability and continues to be meaningful to the interventional pain management community. To help make this sustainable, please help us with your comments and suggestions to improve future publications to provide you with the best information in ways that are most suited to your needs.

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Part I

Basic Considerations

Evolution of Interventional Techniques

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Introduction

Chronic pain is a complex and multidimensional problem. Chronic pain is defined as "pain that persists 6 months after an injury and beyond the usual course of an acute disease or a reasonable time for a comparable injury to heal, that is associated with chronic pathologic processes that cause continuous or intermittent pain for months or years, that may continue in the presence or absence of demonstrable pathologies; may not be amenable to routine pain control methods; and healing may never occur" [1, 2]. Other definitions include pain that persists beyond the usual course of an acute disease or a reasonable time for an injury to heal that is associated with chronic pathologic processes that cause continuous pain or pain at intervals for months or years [1–3].

Interventional pain management started with the origins of neural blockade and regional analgesia in 1884 [4]. Since then, regional anesthesia and interventional techniques have evolved by leaps and bounds. Today there are claims of overuse, abuse, and fraud [5, 6].

Due to the explosive increase of interventional techniques, accountable interventional pain management, and value-based practice, the performance of evidence-based, cost-effective, and clinically effective techniques is coming into play.

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History

The development of interventional techniques dates back to the 1884 invention of regional anesthesia by Koller (a colleague of Sigmund Freud) [4, 7]. Based on this foundation, regional analgesia developed into interventional pain management. Subsequently, in 1899 Tuffer [8] described therapeutic nerve blocks in pain management using spinal injections of cocaine to control pain from sarcoma of the leg. In 1903, Cushing described pain relief with nerve blocks [9] along with reports of trigeminal alcohol blockade [10]. During the same time, spinal interventional techniques also started developing, dating back to 1901, with descriptions of caudal epidural injections by three independent investigators in 1 year [11–13].

Around the same time, epidural injections with local anesthetic and various types of nerve blocks were developing. Epidural steroids were described by Robechhi and Capra [14] and transforaminal approach by Lievre [15] in 1952 and 1953. Steroids were reported by Cappio in 1957 [16]. The wide use of epidural steroid injections, since then by multiple approaches, has become very popular [2, 17].

Diagnostic blocks originated from the descriptions of von Gaza [18] in 1924 followed by White [19] conceptualizing the diagnostic utility of procaine block of sensory sympathetic nerves to determine the pathways of peripheral nerves. Subsequently, Steindler and Luck [20] in 1938 described applications for diagnostic interventional techniques. MacNab [21] in 1971 demonstrated the value of diagnostic, selective nerve root blocks in the preoperative evaluation of patients with negative or inconclusive imaging studies and clinical findings of nerve root irritation. The concept of controlled diagnostic blocks was developed by many authors; however, it was popularized by Bogduk [22, 23].

John Bonica nurtured interest in pain medicine and published a seminal work, *The Management of Pain*, in 1953 and started a multidisciplinary clinic in 1960 [24]. Vandam and Eckenhoff [25], in 1954, described the integrative approach.

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- Vandam and Eckenhoff [25], a year after the publication of Bonica's text on the management of pain [24], suggested that the focus should not only be on pain relief from nerve blocks but also on the basic nature of pain and an integrated approach to treatment.

Subsequently, the twenty-first century has been marked with numerous developments of interest to interventional pain physicians and pain sufferers. The unprecedented development and progress in managing chronic pain, specifically utilizing interventional techniques, heralded the evolution of interventional pain management [1, 2, 5, 6].

Definitions

- The National Uniform Claim Committee (NUCC) [26] defined interventional pain management as "the discipline of medicine devoted to the diagnosis and treatment of pain related disorders principally with the application of interventional techniques in managing subacute, chronic, persistent, and intractable pain, independently or in conjunction with other modalities of treatments."
- The Medicare Payment Advisory Commission (MedPAC) [27] defined interventional techniques as "minimally invasive procedures including: percutaneous precision needle placement, with placement of drugs in targeted areas or ablation of targeted nerves; and some surgical techniques for the diagnosis and management of chronic, persistent or intractable pain such as laser or endoscopic diskectomy, intrathecal infusion pumps and spinal cord stimulators."

Development

Organizations

- The first organization devoted to interventional pain management was started in 1998.
  - The American Society of Interventional Pain Physicians (ASIPP) was conceived in 1998 and has evolved into a premier organization representing more than 50% of interventional pain physicians in the United States.
- The first multidisciplinary organization, entitled the International Association for the Study of Pain (IASP), was started by Bonica in 1974. It eventually took shape as a biopsychosocial organization.
  - The American Pain Society, the American Chapter of IASP, was established in 1977.
  - This was followed by the American Academy of Pain Medicine, which was founded in 1983.

Specialty Designation

- Due to the efforts of ASIPP, a specialty code for interventional pain management was conceived in 2001. However, it was converted into pain management (−72) and later on pain medicine [28].
  - A specific code for interventional pain management (−09) was provided by the Centers for Medicare and Medicaid Services (CMS), along with a definition of interventional pain management in 2003 [29].
  - CMS has recognized interventional pain management as an evolving, but crucial specialty, leading to representation on the Carrier Advisory Committees in each state in the United States [30].

Board Certification

- The American Board of Anesthesiology provided its first subspecialty certification in pain medicine in 1993.
  - The American Board of Pain Medicine provided a board certification in 1993.
  - In 2005, the American Board of Interventional Pain Physicians was established.
  - On the international front, the World Institute of Pain established a fellow of interventional pain practice, testing the competency of physicians in performing interventional techniques.
  - A subspecialty in pain medicine is now provided by the American Board of Anesthesiology, the American Board of Physical Medicine and Rehabilitation, the American Board of Psychiatry and Neurology, and the emergency/sports medicine. They are ABMS-recognized boards; others are in consideration.
- The American Board of Interventional Pain Physicians, specifically established for interventional pain physicians to promote didactic and practical competency, provides a comprehensive examination system. Part I establishes a candidate's didactic knowledge, followed by competency testing via oral examination and a practical examination that assess competency of interventional techniques.
  - The American Board of Interventional Pain Physicians also provides multiple competency examinations in controlled substance management, practice management, and fluoroscopic safety.

Accountable Interventional Pain Management

The prevalence, costs, and disability associated with chronic pain continue to escalate. So too, the numerous modalities of treatments applied in managing these patients continue to increase as

Table 1.1 Utilization of interventional techniques in fee-for-service Medicare population from 2000 to 2013

	Epidural and adhesiolysis procedures		Facet joint interventions and SI joint blocks		Disk procedures (discography and disk decompression)		Other types of nerve blocks		Total		
	Services (facility %)	*Rate*	Services (facility %)	*Rate*	Services (facility %)	*Rate*	Services (facility%)	*Rate*	Services (facility%)	*Change from previous year*	*Rate*
2000	860,787 (79%)	*2172*	424,796 (67%)	*1072*	14,983 (87%)	*38*	168,929 (42%)	*426*	1,469,495 (72%)	–	*3708*
2001	1,013,552 (78%)	*2531*	543,509 (62%)	*1357*	17,229 (87%)	*43*	186,166 (38%)	*465*	1,760,456 (69%)	*19.8%*	*4396*
2002	1,199,324 (74%)	*2961*	708,186 (58%)	*1748*	20,194 (81%)	*50*	255,348 (30%)	*630*	2,183,052 (64%)	*24.0%*	*5390*
2003	1,370,862 (71%)	*3333*	884,035 (53%)	*2150*	24,362 (80%)	*59*	280,064 (27%)	*681*	2,559,323 (60%)	*17.2%)*	*6223*
2004	1,637,494 (65%)	*3924*	1,354,242 (46%)	*3245*	24,263 (79%)	*58*	319,048 (26%)	*765*	3,335,047 (54%)	*30.3%*	*7992*
2005	1,776,153 (65%)	*4180*	1,501,222 (47%)	*3533*	27,950 (78%)	*66*	355,374 (26%)	*836*	3,660,699 (54%)	*9.8%*	*8614*
2006	1,870,440 (63%)	*4316*	1,896,688 (40%)	*4376*	27,432 (75%)	*63*	351,564 (26%)	*811*	4,146,124 (49%)	*13.3%*	*9567*
2007	1,940,454 (62%)	*4384*	1,820,695 (46%)	*4113*	25,688 (73%)	*58*	324,290 (30%)	*733*	4111,127 (52%)	*−0.8%*	*9288*
2008	2,041,155 (61%)	*4495*	1,974,999 (46%)	*4349*	27,735 (70%)	*61*	389,522 (29%)	*858*	4,433,411 (51%)	*7.8%*	*9763*
2009	2,136,035 (59%)	*4664*	2,111,700 (46%)	*4611*	25,929 (69%)	*57*	372,015 (67%)	*812*	4,645,679 (49%)	*4.8%*	*10,143*
2010	2,226,486 (57%)	*4746*	1,937,582 (48%)	*4130*	22,003 (62%)	*47*	392,906 (34%)	*838*	4,578,977 (52%)	*−1.4%*	*9760*
2011	2,309,906 (58%)	*4782*	2,064,227 (50%)	*4274*	19,104 (61%)	*40*	422,436 (66%)	*875*	4,815,673 (48%)	*5.2%*	*9970*
2012	2,324,563 (58%)	*4621*	2,159,057 (50%)	*4292*	18,017 (57%)	*36*	446,337 (36%)	*887*	4,947,974 (53%)	*2.7%*	*9837*
2013	2,278,790 (58%)	*4391*	2,197,766 (51%)	*4235*	15,394 (51%)	*30*	441,000 (37%)	*850*	4,932,950 (53%)	*−0.3%*	*9505*
Change	165%	102%	417%	295%	3%	−22%	161%	99%	236%	–	156%
Average	7.80%	*5.6%*	13.50%	*11.1%*	0.20%	*−1.8%*	7.70%	*5.4%*	9.80%	–	*7.5%*

Rate per 100,000 Medicare beneficiaries; *IPM* interventional pain management
Change: Change from 2000 to 2013; Average – geometric average annual change

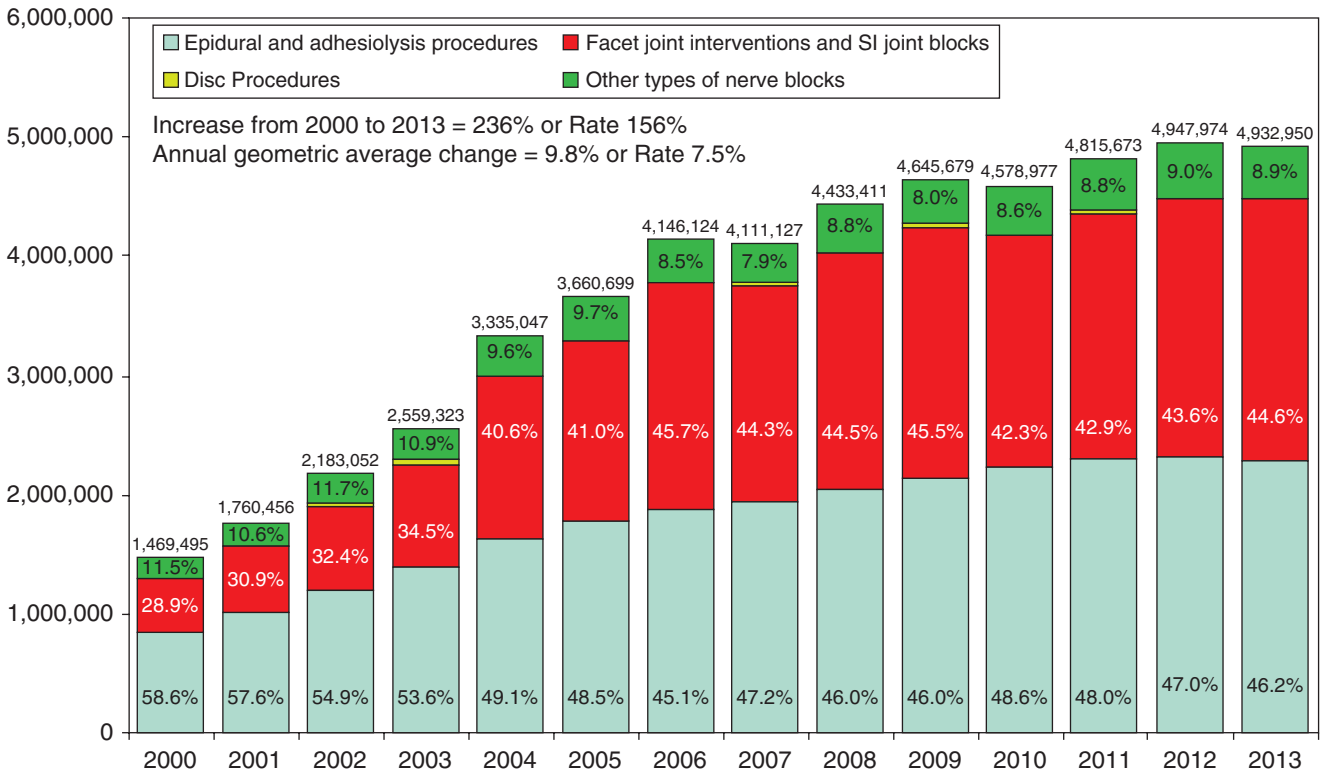


Fig. 1.1 Illustration of distribution of procedural characteristics by type of procedures from 2000 to 2013

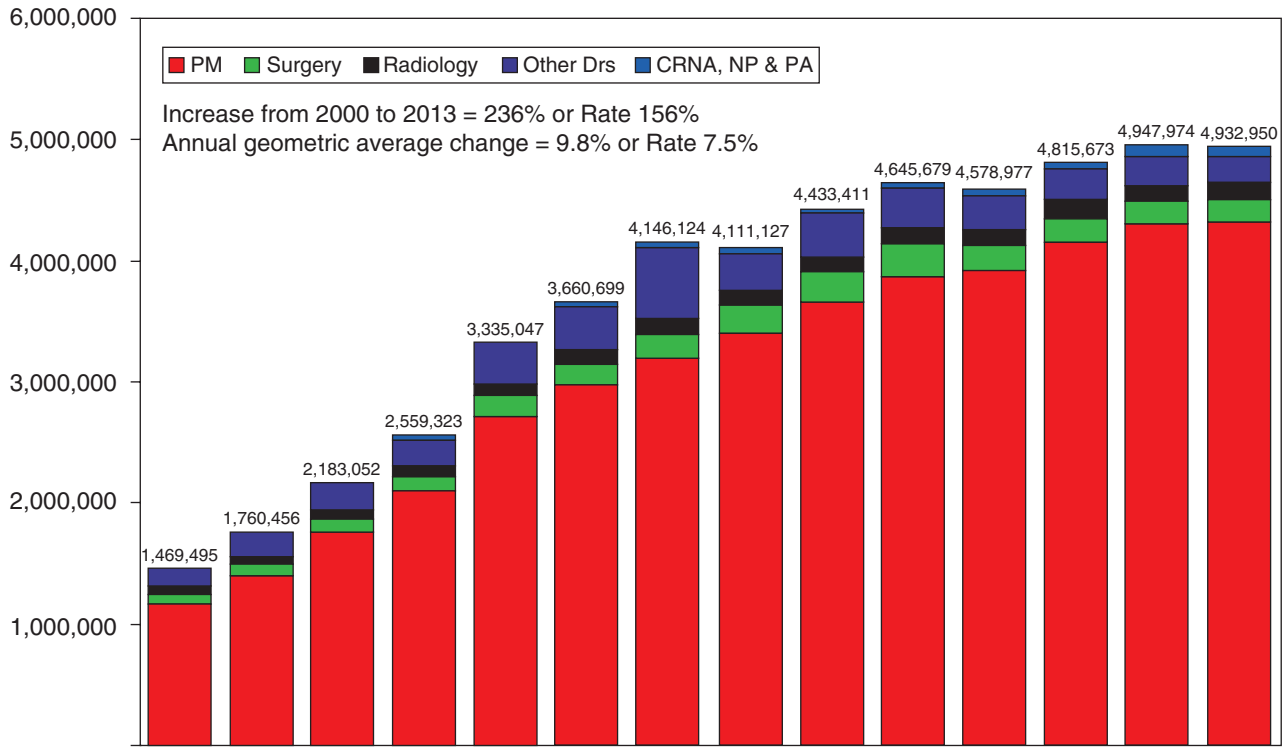
well. In the period from 2000 to 2013 (Table 1.1 and Figs. 1.1 and 1.2), interventional techniques increased 236% [31, 33]. In addition, an analysis of utilization trends and expenditures for spinal interventional techniques alone from 2000 to 2008 illustrates an increase in Medicare fee-for-service expenditures of 240% in terms of dollars spent in the United States [34]. The Office of Inspector General (OIG) of the Department of Health and Human Services showed an increase in facet joint and transforaminal epidural injections; a significant proportion of these services did not meet medical necessity criteria [35, 36].

Overall utilization of procedures has increased by 169.2%, with a rate of 105.6% per 100,000 Medicare beneficiaries for epidural injections (Table 1.2 and Fig. 1.3); 415%, with a rate of 293% for facet joint interventions (Table 1.3 and Fig. 1.4); and overall 438% with a rate of 311% for sacroiliac joint interventions (Table 1.4 and Fig. 1.5). Certain high-volume interventions, such as lumbar transforaminal epidural injections and lumbar facet joint neurolysis, have increased a startling 786.6% and 715%, respectively.

Coverage policies across ambulatory settings and by multiple payers are highly variable. Apart from variability in the development of coverage policies, payments also substantially vary by site of service. In general, among the various ambulatory settings, the highest payments are made to hospital outpatient departments (HOPDs) and the lowest to in-office procedures, with payment to ambulatory surgery centers (ASCs) falling somewhere in the middle [37–39].

Evolving Role

- Interventional pain management is an emerging specialty. Consequently, the problems faced by this specialty may be disproportionate compared to established specialties.
  - Interventional pain management is also faced with increased utilization. Increased utilization will reduce the reimbursement for procedures, as the total amounts disbursable are limited, also known as budget neutrality.
- Rapid advances in interventional pain management have enhanced the ability of physicians to diagnose and treat a variety of painful conditions:
  - This enhanced ability often leads to improved outcomes for patients. However, these improvements, combined with a rise in entrepreneurial activity by physicians, the practice of defensive medicine in order to avoid malpractice suits, and the power of patients who demand more tests and treatments, have led to sharp increases in the volume of interventional pain management services and the expenditures for them.
  - This is similar to imaging services. For imaging services, in recent years, growth in spending has outstripped that of most other services covered by Medicare and private insurers.
- Many private insurers either have narrowed or may narrow their provider networks, may require all interven-



Specialty (%)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Pain Management	80.1%	78.9%	80.4%	82.0%	81.5%	81.3%	77.1%	82.8%	82.8%	83.5%	85.6%	86.4%	86.9%	87.8%
Surgery	6.3%	6.0%	5.7%	5.2%	5.1%	5.0%	5.1%	5.6%	5.6%	5.9%	4.9%	4.3%	4.0%	3.8%
Radiology	2.8%	2.8%	2.9%	3.0%	2.8%	2.8%	2.7%	2.7%	2.6%	2.7%	2.6%	2.6%	2.6%	2.4%
Other Physicians	9.9%	11.2%	10.0%	8.9%	9.9%	10.0%	14.4%	7.9%	8.0%	7.0%	5.8%	5.4%	4.9%	4.7%
CRNA, NP & PA	1.0%	1.2%	1.1%	0.9%	0.8%	0.8%	0.9%	1.0%	1.0%	1.0%	1.1%	1.3%	1.5%	1.3%

Fig. 1.2 Utilization of interventional pain management techniques by specialty from 2000 to 2013, in Medicare recipients

tional pain management services be preauthorized, and may either have imposed or may impose other constraints to prove medical necessity and brand many procedures as experimental or investigational.

- Much of the rapid growth in interventional techniques is attributable to the expanded coverage of procedures in multiple settings including facility and nonfacility, increased understanding of the pain and the ability of understanding by the patient community to be managed for their pain problems, the emergence of sophisticated and accurate diagnostic and therapeutic interventions, and the emergence of evidence-based medicine and clinical guidelines.
- Based on growth patterns and various other issues, Medicare and other insurers have been developing coverage policies at various levels:
  - While coverage policies generally reduce utilization, they may also improve appropriate care by documenting medical necessity and reduce fraud and abuse investigations.
- Interventional pain management is a predominantly procedural-based service in contrast to pain medicine, which is a cognitive-based service.
- The recent proposed changes to the physician fee schedule methodology could be harmful for the specialty of interventional pain management.
  - At the same time, this may be an opportunity for interventional pain management to establish not only its distinctive nature differing from pain medicine and other specialties but also to establish practice values, within the framework of budget neutrality.

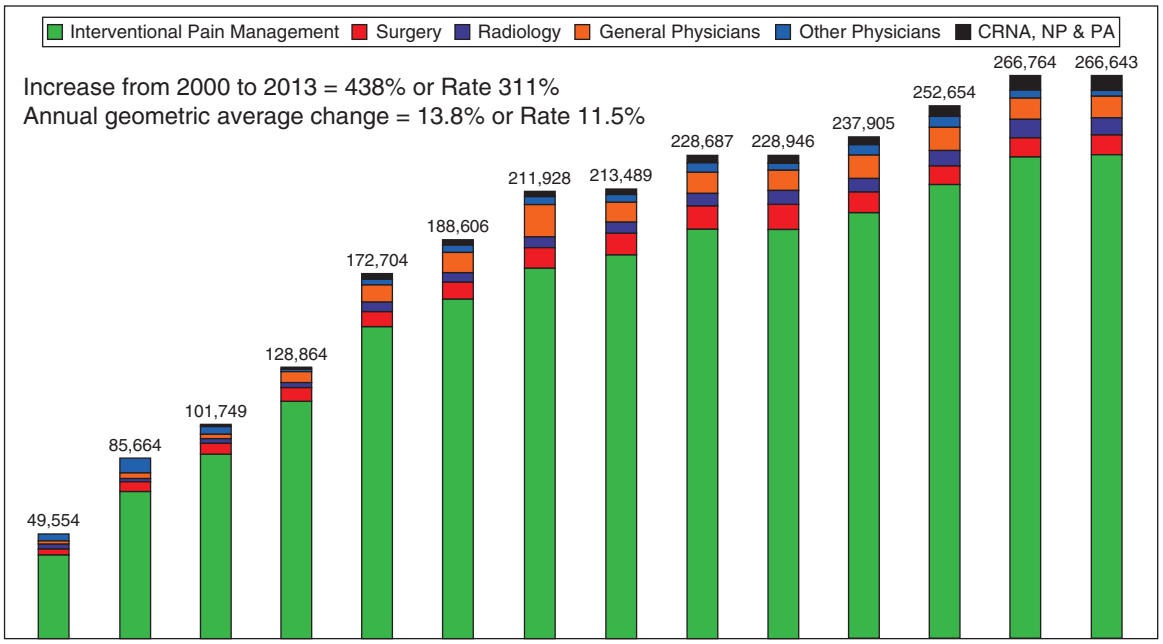
Key Points

1. The twenty-first century is marked with numerous developments of interest to interventional pain physicians and pain sufferers.
2. Interventional pain management is defined as the discipline of medicine devoted to the diagnosis and treatment

Table 1.2 Characteristics of Medicare beneficiaries and sacroiliac joint injections

	US Population (,000)			Medicare beneficiaries (,000)						SI joint injections		
Year	**All ages**	≥ 65 years	Percent	≥ 65 years	Percent	< 65 years	Percent	**Total Medicare beneficiaries**	% to USA	**Services**	% of change from previous year	**Rate per 100,000 Medicare beneficiaries**
Y2000	**282,172**	35,077	12.4%	34,262	86.5%	5370	13.5%	**39,632**	14.0%	**49,554 (59%)**	–	**125**
Y2001	**285,040**	35,332	12.4%	34,478	86.1%	5567	13.9%	**40,045**	14.0%	**85,664 (51%)**	72.9%	**214**
Y2002	**288,369**	35,605	12.3%	34,698	85.7%	5805	14.3%	**40,503**	14.0%	**101,749 (48%)**	18.8%	**251**
Y2003	**290,211**	35,952	12.4%	35,050	85.2%	6078	14.8%	**41,126**	14.2%	**128,864 (42%)**	26.6%	**313**
Y2004	**292,892**	36,302	12.4%	35,328	84.7%	6402	15.3%	**41,729**	14.2%	**172,704 (41%)**	34.0%	**414**
Y2005	**295,561**	36,752	12.4%	35,777	84.2%	6723	15.8%	**42,496**	14.4%	**188,606 (42%)**	9.2%	**444**
Y2006	**299,395**	37,264	12.4%	36,317	83.8%	7022	16.2%	**43,339**	14.5%	**211,928 (40%)**	12.4%	**489**
Y2007	**301,290**	37,942	12.6%	36,966	83.5%	7297	16.5%	**44,263**	14.7%	**213,489 (41%)**	0.7%	**482**
Y2008	**304,056**	38,870	12.8%	37,896	83.4%	7516	16.6%	**45,412**	14.9%	**228,687 (42%)**	7.1%	**504**
Y2009	**307,006**	39,570	12.9%	38,177	83.3%	7624	16.6%	**45,801**	14.9%	**228,946 (42%)**	0.1%	**500**
Y2010	**308,746**	40,268	13.0%	38,991	83.1%	7923	16.9%	**46,914**	15.2%	**237,905 (42%)**	3.9%	**507**
Y2011	**313,848**	41,122	13.1%	39,132	83.4%	7786	16.6%	**46,918**	14.9%	**252,654 (43%)**	6.2%	**523**
Y2012	**313,874**	43,144	13.8%	8500	16.9%	41,900	83.3%	**50,300**	16.0%	**266,764 (45%)**	5.6%	**530**
Y2013	**316,129**	44,704	14.1%	8800	17.0%	43,100	83.0%	**51,900**	16.4%	**266,643 (47%)**	−0.05%	**514**
Change from 2000 to 2013	12%	27%	14%	64%	26%	26%	−4%	31%	17%	438%	–	311%
Geometric average annual change	0.9%	1.9%	1.0%	3.9%	1.8%	<65 years	Percent	2.1%	1.2%	13.8%	–	11.5%

() shows percentage of procedures utilized in facility settings (HOPD and ASC)



Specialty	F2000	F2001	F2002	F2003	F2004	F2005	F2006	F2007	F2008	F2009	F2010	F2011	FY2012	F2013
IPM	40,274	70,302	87,540	112,933	147,395	160,850	176,141	182,960	194,437	194,326	202,386	215,207	228,968	229,739
Surgery	2,778	4,316	5,101	5,925	7,507	8,215	8,996	9,464	10,748	11,552	9,473	9,005	8,994	9,361
Radiology	2,171	1,606	2,210	3,020	4,155	4,566	4,880	5,582	6,187	6,563	6,570	7,288	8,253	8,019
Ganeral Physicians	1,260	2,663	2,950	4,781	9,047	9,817	16,132	9,627	10,177	10,023	11,360	11,079	10,625	10,278
Other Physicians	3,050	6,606	3,589	1,584	2,951	3,296	3,152	3,251	4,508	3,609	4,584	5,122	3,563	3,380
CRNA, NP & PA	21	171	359	621	1,649	1,862	2,627	2,605	2,630	2,873	3,532	4,953	6,361	5,866
Total	49554	85664	101749	128864	172704	188606	211928	213489	228687	228946	237905	252654	266764	266643

Fig. 1.3 Frequency of utilization of sacroiliac joint injections by specialty groups from 2000 to 2013, in Medicare recipients

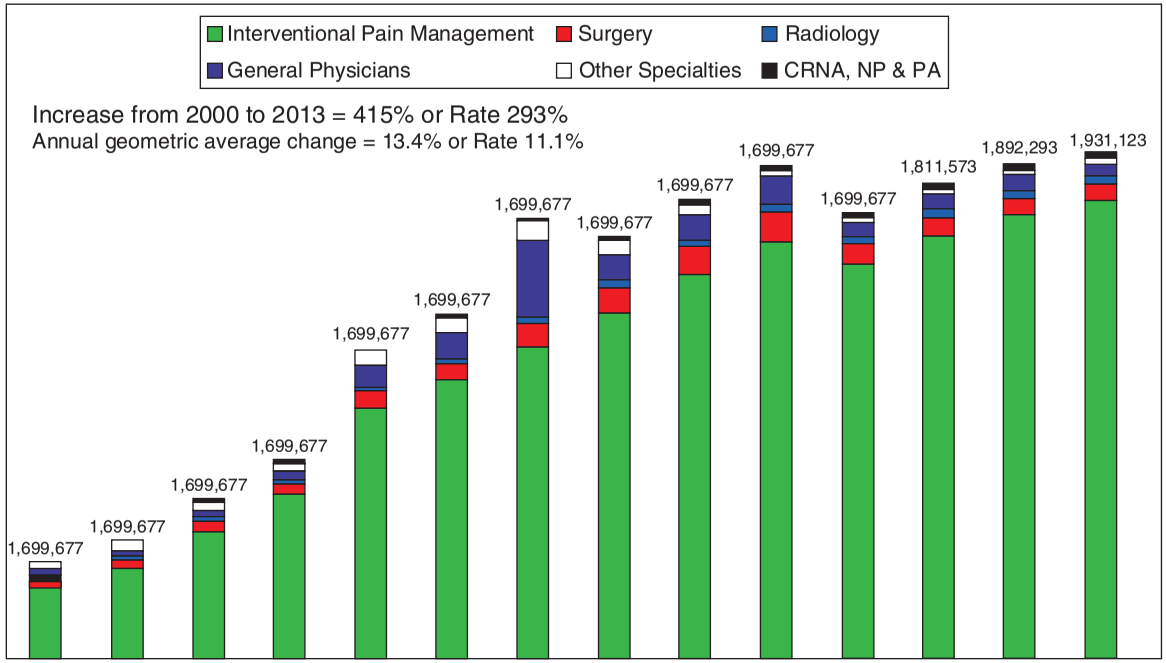
of pain and related disorders by the application of interventional techniques in managing subacute, chronic, persistent, and intractable pain, independently or in conjunction with other modalities of treatments.

3. Interventional techniques are defined as minimally invasive procedures, such as percutaneous precision needle placement of drugs in targeted areas, ablation of targeted nerves, and some surgical techniques, such as discectomy and the implantation of intrathecal infusion pumps and spinal cord stimulators.
4. Chronic pain is considered an acute, recurrent problem that is characterized by periods of quiescence punctuated by flare-ups or, similar to chronic diseases, like diabetes or hypertension, requiring long-term treatment with ongoing care.
5. The first news of neural blockade followed reports from Koller of the numbing effect of cocaine on the tongue in 1884. A description of a therapeutic nerve block occurred in 1899 and a description of caudal epidural injections in 1901.
6. Diagnostic blockade in pain management was pioneered as early as 1924 when von Gaza used procaine for determining the pathways of obscure pain.
7. Board certifications are available by ABMS-recognized boards in anesthesiology, PM&R, and neurology and psychiatry.
8. Overall interventional techniques have increased by 236% with a rate of 156% per 100,000 Medicare beneficiaries; for epidural injections 169.2% with a rate of 105.6%; for facet joint interventions 415% with a rate of 293%, and for sacroiliac joint interventions 438% with a rate of 311%. High-volume interventions such as lumbar transforaminal epidural injections and lumbar facet joint neurolysis have increased by 786.6% and 715%, respectively.
9. Coverage policies across ambulatory settings and multiple payers have been extremely variable with a differential of 70% to 300% higher payments in hospital settings.
10. The primary role of physicians is to improve the health and well-being of patients, with the future of interventional pain management being promising.

Table 1.3 Utilization rates (per 100,000 Medicare recipients) of various facet joint interventions in the Medicare population from 2000 to 2013

	Facet joint blocks								Facet neurolysis								All facet joint interventions	
	Cervical/thoracic				Lumbar/sacral				Cervical/thoracic				Lumbar/sacral					
Year	64470	64472	Total	Rate	64475	64476	Total	Rate	64626	64627	Total	Rate	64622	64623	Total	Rate	Services	Rate
F2000	24,751	33,573	58,324	147	101,539	153,252	254,791	643	2750	6054	8804	22	15,117	38,206	53,323	135	375,242	947
F2001	34,500	47,684	82,184	205	121,234	175,854	297,088	742	3815	8334	12,149	30	18,792	47,632	66,424	166	457,845	1143
F2002	41,935	61,981	103,916	257	155,620	240,243	395,863	977	5190	12,202	17,392	43	25,744	63,522	89,266	220	606,437	1497
F2003	49,958	75,489	125,447	305	189,263	299,802	489,065	1189	6877	15,301	22,178	54	35,315	83,166	118,481	288	755,171	1836
F2004	77,620	126,145	203,765	488	286,394	467,823	754,217	1807	10,691	23,461	34,152	82	57,053	132,351	189,404	454	1,181,538	2831
F2005	86,541	141,999	228,540	538	316,158	519,689	835,847	1967	12,015	26,298	38,313	90	63,228	146,688	20,9916	494	1,312,616	3089
F2006	121,312	204,178	325,490	751	370,809	636,673	1,007482	2325	14,207	31,993	46,200	107	79,289	226,299	305,588	705	1,684,760	3887
F2007	108,103	179,279	287,382	649	365,372	599,568	964,940	2180	17,689	39,710	57,399	130	88,069	209,416	29,7485	672	1,607,206	3631
F2008	114,497	201,857	316,354	697	385,491	634,775	1,020,266	2247	20,729	48,089	68,818	152	100,606	240,268	340,874	751	1,746,312	3845
F2009	126,730	214,802	341,532	746	418,036	663,690	1,081,726	2362	25,510	57,973	83,483	182	112,627	263,386	376,013	821	1,882,754	4111
F2010	114,753	175,887	290,640	620	386,897	557,572	944,469	2013	26,588	59,219	85,807	183	116,959	261,802	378,761	807	1,699,677	3623
F2011	124,431	192,789	317,220	657	402,507	587,942	990,449	2051	29,904	67,622	97,526	202	125,630	280,748	406,378	841	1,811,573	3751
F2012	131,377	203,374	334,751	666	426,386	623,110	1,049,496	2086	35,621	66,096	101,717	202	141,130	265,202	406,332	808	1,892,293	3762
F2013	135,544	208,375	343,919	663	423,970	619,891	1,043,861	2011	39,055	69,902	108,957	210	155,353	279,033	434,386	837	1,931,123	3721
Change from 2000 to 2013	448%	521%	490%	350%	318%	304%	310%	213%	1320%	1055%	1138%	845%	928%	630%	715%	522%	415%	293%
Geometric average annual change	14.0%	15.1%	14.6%	12.3%	11.6%	11.3%	11.5%	9.2%	22.6%	20.7%	21.3%	18.9%	19.6%	16.5%	17.5%	15.1%	13.4%	11.1%

Rate – Per 100,000 Medicare beneficiaries



Specialty	F2000	F2001	F2002	F2003	F2004	F2005	F2006	F2007	F2008	F2009	F2010	F2011	F2012	F2013
IPM	293373	348361	487624	623975	958026	1062122	1189969	1321299	1471781	1590968	1506222	1615790	1689488	1752421
Surgery	29492	34792	40473	42933	61550	67862	85456	97668	100938	113131	75263	69107	66247	61910
Radiology	10141	11609	14144	16782	17395	19703	24081	23373	25037	27869	25690	28190	29058	24349
Ganeral Physicians	17243	19921	24540	37566	85077	94106	302208	96760	96749	109488	60048	61390	65794	51582
Other Specialties	24850	42494	38045	31380	54702	63327	74936	57525	37430	25203	13974	15833	15302	25445
CRNA, NP & PA	143	668	1611	2535	4788	5496	8110	10581	14377	16095	18480	21263	26404	15416
Total	375242	457845	606437	755171	1181538	1312616	1684760	1607206	1746312	1882754	1699677	1811573	1892293	1931123

Fig. 1.4 Frequency of utilization of facet joint injections by specialty groups from 2000 to 2013, in Medicare recipients

Table 1.4 Utilization of epidural injections in the Medicare population from 2000 to 2013

	Interlaminar epidurals				Transforaminal epidurals									
					Cervical/thoracic				Lumbar/sacral					
	Cervical/thoracic CPT 62310		Lumbar/sacral CPT 62311		CPT 64479	CPT 64480	Total		CPT 64483	CPT 64484	Total		Total epidural injections	
Year	Services	Rate	Services	Rate	Services	Services	Services	Rate	Services	Services	Services	Rate	Services	Rate
2000	75,741	191	618,362	1560	13,454	9434	22,888	58	85,006	37,477	122,483	309	839,474	2118
2001	84,385	211	702,713	1755	14,732	8537	23,269	58	125,534	53,133	178,667	446	989,034	2470
2002	99,117	245	786,919	1943	18,583	10,835	29,418	73	177,679	79,115	256,794	634	1,172,248	2894
2003	109,783	267	838,858	2040	21,882	15,769	37,651	92	242,491	114,046	356,537	867	1,342,829	3265
2004	130,649	313	878,174	2104	25,182	18,094	43,276	104	363,744	196,044	559,788	1341	1,611,887	3863
2005	141,652	333	945,350	2225	27,844	20,525	48,369	114	395,508	216,892	612,400	1441	1,747,771	4113
2006	146,748	339	946,961	2185	29,822	23,073	52,895	122	452,125	245,453	697,578	1610	1,844,182	4255
2007	156,415	353	926,029	2092	29,938	22,266	52,204	118	506,274	274,305	780,579	1764	1,915,227	4327
2008	165,636	365	905,419	1994	32,286	24,003	56,289	124	572,340	317,448	889,788	1959	2,017,132	4442
2009	175,503	383	888,166	1939	37,012	27,487	64,499	141	632,658	351,685	984,343	2149	2,112,511	4612
2010	184,750	394	888,421	1894	40,003	29,888	69,891	149	679,117	383,128	1,062,245	2264	2205,307	4701
2011	200,134	414	914,324	1893	38,970	26,628	65,598	136	710,638	398,519	1,109,157	2296	2,289,213	4740
2012	213,390	424	925,176	1839	35,945	21,293	57,238	114	718,437	390,749	1,109,186	2205	2,304,993	4582
2013	217,393	419	901,468	1737	34,699	20,409	55,108	106	700,820	385,098	1,085,918	2092	2,259,887	4354
Change	187.0%	119.2%	45.8%	11.3%	157.9%	116.3%	140.8%	83.9%	724.4%	927.6%	786.6%	577.0%	169.2%	105.6%
GM	8.4%	6.2%	2.9%	0.8%	7.6%	6.1%	7.0%	4.8%	17.6%	19.6%	18.3%	15.8%	7.9%	5.7%

Rate – Per 100,000 Medicare beneficiaries; *Change* – from 2000 to 2013; *GM* geometric average annual change