Practice Guidelines

Interventional Techniques in the Management of Chronic Pain: Part 1.0

From The Association of Pain Management Anesthesiologists

Laxmaiah Manchikanti, MD*, Vijay Singh, MD*, Cyrus E. Bakhit*, MD, and Bert Fellows, MA**

Disclaimer

The following guidelines are meant to provide practical considerations for the use of interventional techniques in the management of chronic pain based on the current state of the art and science of interventional pain management. Hence, these guidelines do not constitute inflexible treatment recommendations. It is expected that a provider will establish a plan of care on a case by case basis taking into account an individual patient’s medical condition, personal needs, and preferences, and the physician’s experience. Based on an individual patient’s needs, treatment different from that outlined here will be warranted.

The practice guidelines for interventional techniques in the management of chronic pain are systematically developed statements to assist practitioner and patient decisions about appropriate health care related to chronic pain. These guidelines are professionally derived recommendations for practices in the diagnosis and treatment of chronic or persistent pain. They were developed utilizing a combination of evidence and consensus to improve quality of care, increase patient access, improve patient outcomes, improve appropriateness of care, improve efficiency and effectiveness, and achieve cost containment.

Included in the guidelines is a discussion of their purpose, rationale, importance, and methodology, and patient population, pathophysiologic basis, and various interventional techniques utilized in the management of chronic pain including rationale, outcomes, and cost effectiveness. They also describe the role of diagnostic blocks and therapeutic blocks with suggested algorithms for interventional techniques in the management of conservative care of chronic pain.

Keywords: Intervventional techniques, neural blockade, chronic pain, epidural injections, percutaneous epidural adhesiolysis, discography, facet joint mediated pain, radiofrequency.

The Association of Pain Management Anesthesiologists (AOPMA) guidelines for interventional techniques in the management of chronic pain were developed by a multi-disciplinary team of professionals. The core group of members included Laxmaiah Manchikanti, MD; Cyrus E. Bakhit, MD; Rajgopal R. Pakanati, MD; Vijay Singh, MD; Ramesh Amara, MD*; Abu Matin, MD*; Bert Fellows, MA‡; Patricia Burks, LPT~~; Carla Beyer, RN†; and Kim Damron, RN†.

*Dr. Manchikanti is Executive Director and President of Association of Pain Management Anesthesiologists. *Dr. Singh and Dr. Bakhit are Life Members and Directors of the Association of Pain Management Anesthesiologists. **Mr. Fellows is the Coordinator of the Association of Pain Management Anesthesiologists. Address Correspondence: Laxmaiah Manchikanti, MD, 2831 Lone Oak Road, Paducah, KY 42003

Bakhit, MD; Raigopal R. Pakanati, MD; Vijay Singh, MD; Ramesh Amara, MD*; Abu Matin, MD*; Bert Fellows, MA‡; Patricia Burks, LPT~~; Carla Beyer, RN†; and Kim Damron, RN†.

Following the initial preparation, the guidelines were reviewed by the following members of AOPMA which included physicians specializing in pain management, as well as others, including attorneys and practice management consultants.

* Internist; § Psychologist; ~~ Physical Therapist; ́ Regis-
tered Nurse; ́ Physician’s Assistant; ́ Physical Therapy Assistant; ́ Attorney; ́ Practice Management Consultant; All Others are Interventional Pain Specialists
The reviewers included Bentley A. Ogoke, MD; David M. Schultz, MD; Ballard D. Wright, MD; Peter D. Wright, MD; Steven R. Hayes, MD; Saadat Kamran, MD; Jacob Handszer, MD; M. Ramos Ferdinand, MD; Kent P. Weinmeister, MD; William Mangino, MD; Allan T. Parr, MD; Francis J. Abdou, MD; Kunnathu P. Geevarghese, MD; Bharat C. Shah, MD; Bruce J. Skolnik, MD; Roger W. Kemp, MD; Boris I. Pilch, MD; William L. Weigel, MD; Solomon Kamson, MD; A. Ghafoor Baha, MD; Jose Rivera, MD; David Kloth, MD; Andrea Trescot, MD; Mary Jo Curran, MD; Kenneth Varley, MD; Neeraj Jain, MD; William A. Sarraile, JD; Allison W. Shuren, NP, JD; Dan Johnson**; Della Croft, PA††; and Jamie Day, PTA§§. Multiple comments and suggestions were received from members; these were incorporated into the final draft.

The guidelines were reviewed at the board meeting of AOPMA on January 5, 2000, and were approved unanimously. Those who were in attendance at the board meeting were Laxmaiah Manchikanti, MD; Andrea Trescot, MD; Kenneth Varley, MD; Thomas D. Falasca, DO; Cyrus E. Bakhit, MD; David Kloth, MD; Craig R. DuBois, MD; Bentley A. Ogoke, MD; Kendall Hansen, MD; and Vijay Singh, MD.

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**PURPOSE**

Clinical practice guidelines are commonly defined as “systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances” (1). The practice guidelines are professionally derived recommendations for practices for prevention, diagnosis, treatment, and in some cases, disability management. These clinical practice guidelines for interventional techniques in the management of chronic pain are professionally developed utilizing a combination of evidence and consensus. The purpose of these clinical guidelines is to:

1. Improve quality of care
2. Improve patient access
3. Improve patient outcomes
4. Improve appropriateness of care
5. Improve efficiency and effectiveness
6. Achieve cost containment by improving cost benefit ratio

**RATIONALE AND IMPORTANCE**

The most compelling single reason for the development of these clinical practice guidelines is to improve the quality of pain management, and thus the quality of life of pain sufferers. Available evidence documents a wide degree of variance in the practice of interventional pain management and pain medicine for even the most commonly performed procedure(s) or most commonly treated condition(s) (2-14). These guidelines also will address the issue of systematic evaluation and ongoing care of chronic or persistent pain, and will provide information about the scientific basis of recommended procedures, thus potentially increasing compliance, dispelling misconceptions among providers and patients, managing patient expectations reasonably, and forming the basis of a therapeutic partnership between the patient, the provider, and the payer.

Interventional techniques are crucial both in the diagnostic, as well as the therapeutic, arena of managing pain and providing improvement in the quality of life of the pain sufferers. Due to lack of either conclusive evidence or consensus and because of a wide variation in treatment protocols from practice to practice (and often within a practice) pain management has been incorrectly characterized, often negatively, by some insurance carriers and some other specialties.

**METHODOLOGY**

The two most common methods for the development of guidelines which are often combined, are based on evidence and consensus. These guidelines are a blend of both methodologies. However, evidence as well as consensus has been criticized in the literature (15, 16). The issues of ethics, feasibility, cost, and reliability pose challenges to the randomized trial, which theoretically represents the “gold standard” in interventional pain management (17-24). Due to the poor methodological quality of a large number of published randomized clinical trials on the efficacy of interventions in the management of low back pain, whiplash, and other painful conditions, the authors focused their work on those which consisted of studies well-controlled or high-quality uncontrolled studies with the emphasis on well-controlled studies when available. The focus of these guidelines is physiological, sup-
ported by peer-review literature, and based on the best cost benefit balance for the patient in both the short and long term, and consensus.

**POPULATION**

The population covered by these guidelines includes all the patients who are suffering with chronic pain of either spinal or non-spinal origin eligible to undergo interventional technique.

**CHRONIC PAIN**

"Pain" as John Bonica, father of pain medicine observed in 1974, "is the most pressing issue of modern times." In spite of the best efforts of the public, providers and the government, pain continues to be an epidemic (25, 26). The knowledge and understanding of this complex entity, including diagnosis and treatment, is in its infancy, in spite of modern developments in medicine. Providers, patients, and the government all understand the devastating nature of chronic pain which destroys the quality of life by eroding the will to live, disturbing sleep and appetite, creating fatigue, and impairing recovery from illness or injury (25-27). In elderly patients it may make the difference between life and death by resulting in vocational, social, and family discord (28-30). Pahor et al (30) found that pain relief is particularly elusive for older women with disabling back and lower extremity problems. In this study, approximately two-thirds of the women reported significant levels of pain and difficulty in controlling it.

The concept of chronic pain is beset with controversy starting with its very definition. For some chronic painful conditions, it is defined as, "pain that exists beyond an expected time frame for healing." For other conditions, it is recognized that "healing may never occur." Bonica defined chronic pain as, "Pain which persists a month beyond the usual course of an acute disease or a reasonable time for any injury to heal that is associated with chronic pathologic processes that causes a continuous pain or pain at intervals for months or years" (31). In many cases, chronic pain is understood as persistent pain that is not amenable to routine pain control methods. Two major and controversial terms in today's pain medicine are “chronic pain,” also known as persistent pain, and a second category known as “chronic pain syndrome,” which is a separate and distinct condition (32, 33). Chronic pain syndrome is associated with major psychological and behavioral problems with or without a physical problem. Recurrent pain represents the nidus of chronic pain syndrome.

While chronic pain may be associated with psychological problems such as depression, generalized anxiety disorder, and some behavioral problems, chronic pain syndrome, in contrast is a malevolent and destructive force (32, 33). It is a self-sustaining, self-reinforcing, self-regenerating process, with markedly enhanced perception and with maladaptive and grossly disproportional pain related behavior. However, the literature shows that chronic pain syndrome is not a common phenomenon in general and it is particularly very infrequent in the elderly (34). In addition, Hendler et al (35), to whom a number of suspected “psychosomatic” cases have been referred, found organic origin of the pain in 98% of cases. Subsequently, Hendler and Kolodny (36) estimated that the incidence of psychogenic pain is only 1 in 3000 patients.

Chronic pain has been estimated to cost the American society approximately $120 billion a year in treatment, lost revenues, and wages. Some frightening estimates show that annual total costs for back pain itself, including disability and litigation, are more than $100 billion (37). Annual direct medical costs for back pain are estimated at around $33 billion with chronic pain around $45 billion. Approximately 28% to 30% of the United States population suffer with some kind of chronic painful condition(s) (25-61). Pain of spinal origin effects 80% of the population at some point during their life span. As many as 35% to 79% of the patients may suffer back pain and disability for over one year after its initial onset, contrary to the traditional belief that most back pain is cured in 60 days (56-61).

The tragedy of needless pain and suffering can be avoided to a great extent by appropriate utilization of interventional techniques in managing chronic pain and other non invasive modalities.

**PATHOPHYSIOLOGIC BASIS**

Two major categories of pain are: pain of spinal origin, and pain of non-spinal origin.

Spinal pain is inclusive of all painful conditions originating from spinal structures ranging from the discs to muscles and ligamentous attachments. In contrast, non-spinal pain encompasses a multitude of other painful conditions ranging from peripheral neuralgias to reflex sympathetic dystrophy and arthritis. Virtually every structure in the spine, as well as other organs, has been implicated as a possible source of pain at one or time another. Any structure with a nerve supply capable of causing pain simi-
lar to that seen in clinically normal volunteers, which is susceptible to diseases or injuries that are known to be painful can cause pain (2-4, 13, 14, 62-95). Certain conditions may not be detectable using currently available technology or biochemical studies (2, 3, 13, 14, 50, 70, 71, 84, 85, 97-108). However, for a structure to be implicated, it should have been shown to be a source of pain in patients, using diagnostic techniques of known reliability and validity. The structures responsible for pain in the spine include the vertebrae, intervertebral discs, spinal cord, nerve roots, facet joints, ligaments, muscles, atlanto-occipital joints, atlanto-axial joints, and sacroiliac joints. Similarly, muscles, ligaments, joints, sensory nerves, the sympathetic nervous system, and visceral organs have been implicated in pain of non spinal origin.

Even though disc herniation, strained muscles, and torn ligaments, have been attributed in the past to the cause of most spinal pain either in the neck and upper extremities, upper and mid back, or low back and lower extremities, disorders of the spinal joints, which include facet joints, have been implicated more commonly than disc herniation, attributing some 50% of spinal pain to these joints (13, 14, 72-85, 93-95, 109-120). Facet joints were described as a potential source of low back pain as early as 1911, 20 years earlier than ruptured disc. The existence of lumbar facet joint pain is supported by a preponderance of scientific evidence, even though a few detractors have disputed this. The prevalence of facet joint mediated pain in patients with chronic spinal pain has been established as 15% to 45% in low back pain, and 54% to 60% in neck pain utilizing controlled diagnostic blocks (13, 14, 84, 111-113, 118-120).

The second most common structure responsible for pain in the spine is the intervertebral disc. Even though disc herniation is seen only in a small number of patients, degeneration of the disc resulting in primary discogenic pain is seen much more commonly. In contrast to ruptured disc where pain arises from the nerve root, in discogenic pain a disc with or without internal disruption is implicated rather than the nerve root (65-69, 86-92, 121-127).

Post laminectomy syndrome or pain following operative procedures of the spine, sometimes known as failed management syndrome, is becoming a common entity in modern medicine (128-151). It is estimated that 20 to 30% of spinal surgeries, occasionally up to as high as 40%, may not be successful as a result of either the surgery being inadequate, incorrect, or unnecessary; but also it may result following a well-indicated and well-performed surgical procedure. Even in cases of successful surgery, pain and subsequent disability have returned after variable periods from 6 months to 20 years. In these cases, scar-tissue development, destabilization of the spinal joints, and recurrent or repeat disc herniation may be responsible for continued pain problems. However, surgical results are extremely poor in patients after a failed surgical procedure (147). Other spinal conditions include various degenerative disorders such as spinal stenosis, spondyloysis, spondyloolisthesis, degenerative spondylolysis, idiopathic vertebrogenic sclerosis, diffuse idiopathic spinal hyperostosis, segmental instability; and multiple myofascial syndromes with involvement of muscles and ligaments. While degenerative conditions other than disc disruption and facet arthritis may contribute to approximately 5% to 10% of spinal pain, myofascial pain syndromes are not supported by a prevalence of epidemiological data (100, 101, 152-154).

The causes of non spinal pain include the various causes responsible for headache; trigeminal neuralgia with facial pain; cancer pain with involvement of various musculoskeletal structures either with the spread of the cancer into bones and muscles with compression of the spinal cord, or pain after multiple surgical procedures; pain secondary to pressure on various nerve plexuses resulting in neuropathic pain; and, finally, pain resulting from pathogenic visceral organs. Other causes include reflex sympathetic dystrophy and causalgia or complex regional pain syndromes Types I and II; postherpetic neuralgia, phantom limb pain; and finally, the controversial myofascial pain (101, 152-157).

INTERVENTIONAL TECHNIQUES

The history of the application of interventional techniques in pain management dates back to 1901, when epidural injections for lumbar nerve root compression were reported (158-160). Since then, substantial advances have been made in the administration of epidural injections; and a multitude of other blocks and procedures have been devised (2, 3, 13, 14, 161-174). Thus, neural blockade has been distinguished as the favored, at times decisive, intervention in the diagnostic and therapeutic management of chronic painful conditions.

The general benefits of the various types of nerve blocks including epidurals and neurolytic blocks include pain relief which out lasts by hours, days, and sometimes weeks the transient pharmacologic action of either local
anesthetic or other agents provided. However, clear cut explanations for such benefits are not available. It is believed that neural blockade alters or interrupts nociceptive input, reflex mechanism of the afferent limb, self sustaining activity of the neuron pools and neuraxis, and the pattern of central neural activities (175). The explanations are based in part on the pharmacological and physical actions of local anesthetics, corticosteroids, and other agents. It is also believed that local anesthetics interrupt the pain-spasm cycle and reverberating nociceptor transmission, whereas corticosteroids reduce inflammation either by inhibiting the synthesis or release of the number of pro-inflammatory substances (176-182). Various modes of action of corticosteroids include membrane stabilization; inhibition of neural peptide synthesis or action; blockade of phospholipase A₂ activity, prolonged suppression of ongoing neuronal discharge; suppression of sensitization of dorsal horn neurons; and reversible local anesthetic effect (177-189). In addition, local anesthetics have been shown to produce prolonged dampening of c-fiber activity (190-192). Physical effects include clearing adhesions or inflammatory exudates from the vicinity of the nerve root sleeve. The scientific basis of some of these concepts is proven for spinal pain management with epidural injections of betamethasone, and intravenous methylprednisolone (181, 184, 185, 187).

### Rationale

The rationale for diagnostic neural blockade in the management of spinal pain stems from the fact that clinical features and imaging or neurophysiologic studies do not permit the accurate diagnosis of the causation of spinal pain in the majority of the patients in the absence of disc herniation and neurological deficit (2, 3, 13, 14, 50, 71, 84, 85, 98-108, 111-113). Further rationale is based on the recurring facts showing the overall rate of inaccurate or incomplete diagnosis in patients referred to pain treatment centers to range from 40% to 67%, incidence of psychogenic pain to be only 1 in 3000 patients, and presence of organic origin of the pain in 98% of cases mistakenly branded as psychosomatic cases (35, 36). Finally, the most compelling reason is that chronic low back pain is a diagnostic dilemma in 85% of the patients even in experienced hands with all the available technology (Fig. 1). It has been determined that utilizing alternative means of diagnosis including precision diagnostic blocks in cases where there is a lack of definitive diagnostic radiologic or electrophysiologic criteria, can enable an examiner to identify the source of pain in the majority of patients, thus reducing the proportion of patients who cannot be given a definite diagnosis from 85% to 35% or even as low as 15%.

### Fig. 1. Pitfalls with conventional evaluation of low back pain

“Specific anatomic etiology is clearly and objectively identified in only 10% to 20%.”

1. Radiographic “abnormalities” are frequently clinically irrelevant.
2. True sciatica occurs in only 1 to 2% of the patients.
3. No universal criteria are established for scoring the presence, absence, or importance of particular signs.
4. Quantification of the degree of disability and the association to treatment outcomes is difficult.
5. Interpretation of biomedical findings relies on “clinical judgments,” “physician’s experience,” and “quasi-standardized criteria.”
6. Routine clinical assessment is frequently subjective and unreliable.
7. Physical examination and diagnostic findings are subjective.
8. The discriminative power of common objective signs has been questioned.
9. Reliance on general “clinical impression” to detect gross psychological disturbances is “hopelessly inaccurate.”
10. It is usually not possible to make a precise diagnosis or identify anatomic origin of the pain by routine clinical assessment.

Adapted and modified from Waddell and colleagues (103).
The rationale for therapeutic interventional techniques, including neural blockade in the spine, is based upon several considerations: the cardinal source of chronic spinal pain, namely discs and joints, are accessible to neural blockade; removal or correction of structural abnormalities of the spine may fail to cure and may even worsen painful conditions; degenerative processes of the spine and the origin of spinal pain are complex; and the effectiveness of a large variety of therapeutic interventions in managing chronic spinal pain has not been demonstrated conclusively (2, 3, 11-14, 17, 47, 50, 71, 102-108, 140, 150, 151, 154, 193-215).

**Facet Joint Blocks:** Facet joint blocks include facet joint injections, atlanto-occipital joints, atlanto-axial joints, and sacroiliac joints, or interruption of sensory nerve supply to these joints by neurolysis (2, 3, 13, 14, 216-278). Facet joint-mediated pain is the single most common cause

### Table 1. Results of published reports of effectiveness of facet joint injections

<table>
<thead>
<tr>
<th>Study</th>
<th>Study Characteristics</th>
<th>No. of Patients</th>
<th>Drugs Utilized</th>
<th>Initial Relief 1-4 weeks Control vs Treatment</th>
<th>Long-term relief 3 months vs 6 months</th>
<th>Results P - Positive N - Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lumbar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carette et al (259)</td>
<td>P, PC, RA</td>
<td>101</td>
<td>NS, LA, S</td>
<td>33 vs 42%</td>
<td>N/A</td>
<td>15% vs 46%</td>
</tr>
<tr>
<td>Lynch &amp; Taylor (271)</td>
<td>P, C</td>
<td>50</td>
<td>LA, S</td>
<td>50% vs 92%</td>
<td>62%</td>
<td>N/A</td>
</tr>
<tr>
<td>Murtagh (267)</td>
<td>P, C</td>
<td>100</td>
<td>NS, LA</td>
<td>94%</td>
<td>54%</td>
<td>N/A</td>
</tr>
<tr>
<td>Lewineck &amp; Warfield (266)</td>
<td>R</td>
<td>21</td>
<td>LA, S</td>
<td>75%</td>
<td>33%</td>
<td>N/A</td>
</tr>
<tr>
<td>Lippit (264)</td>
<td>R</td>
<td>99</td>
<td>LA, S</td>
<td>N/A</td>
<td>52%</td>
<td>N/A</td>
</tr>
<tr>
<td>Lau et al (265)</td>
<td>P</td>
<td>34</td>
<td>LA, S</td>
<td>56%</td>
<td>44%</td>
<td>35%</td>
</tr>
<tr>
<td>Liliuss (270)</td>
<td>P, RA, PC</td>
<td>109</td>
<td>NS, LA, S</td>
<td>N/A</td>
<td>64%</td>
<td>N/A</td>
</tr>
<tr>
<td>Nash (217)</td>
<td>P, RA</td>
<td>66</td>
<td>LA, S</td>
<td>58%</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Marks et al (216)</td>
<td>P, RA</td>
<td>86</td>
<td>LA, S</td>
<td>45%</td>
<td>18%</td>
<td>N/A</td>
</tr>
<tr>
<td>Mironer &amp; Somerville (113)</td>
<td>C</td>
<td>148</td>
<td>LA, S</td>
<td>28%</td>
<td>28%</td>
<td>N/A</td>
</tr>
<tr>
<td>Cervical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barnsley (256)</td>
<td>P, RA, PC</td>
<td>41</td>
<td>LA, S</td>
<td>50%</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Dory (272)</td>
<td>R</td>
<td>14</td>
<td>LA, S</td>
<td>64%</td>
<td>36%</td>
<td>N/A</td>
</tr>
<tr>
<td>Roy et al (253)</td>
<td>R</td>
<td>21</td>
<td>LA, S</td>
<td>91%</td>
<td>62%</td>
<td>N/A</td>
</tr>
</tbody>
</table>

P - Prospective; RA - Randomized; C - Controlled; PC - Placebo Controlled; R - Retrospective; LA - Local Anesthetic; NS - Normal Saline; S - Steroids
of spinal pain in 40% to 60% of the patients (13, 14, 84, 111-113, 118-120).

The specific rationale for facet-joint blocks is based on the observation that, if a particular joint is determined to be the source of pain generation, long-term relief can be sought by directing therapeutic interventions at that joint.

In managing low back pain, local anesthetic injection into the facet joints or interruption of the nerve supply to the facet joints has been accepted as the standard for diagnosis of facet-joint mediated pain. Since a single joint is innervated by at least two medial branches, two adjacent levels should always be blocked. Effectiveness of facet-joint injections, facet-joint nerve blocks, and facet-joint neurolysis has been reasonably studied, though the results have varied widely (2, 3, 13, 112, 113, 216-218, 222-2273). The evidence for lumbar intra-articular injections of steroids with or without local anesthetic is in favor of the injections in well-controlled studies, even though the evidence is not unequivocal (Table 1). Studies of intra-articular injections showed short-term relief in 46% to 75% of the patients, while long-term relief was seen only in 20% to 36% of the patients following a single injection. The role of medial branch blocks in the diagnosis of facet-joint pain has been well described and is considered superior to intra-articular comparative local anesthetic blocks. However, for therapeutic purposes, the literature is sparse and the few studies which do exist have reported that facet-joint injections and medial branch blocks are of equal value (13, 112, 216-218). Multiple reports showing the effectiveness of radiofrequency neurolysis were encouraging (Table 2).

In contrast, most of the positive results of cervical intra-articular injection of corticosteroids and medial branch blocks were from uncontrolled reports. The most

<p>| Table 2. Results of published reports on effectiveness of radiofrequency neurolysis |
|----------------------------------|-----------------|--------------|-----------------|-----------------|----------|------------|
| Study Characteristics            | No. of Patients | Initial Relief | Long-term relief |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Control vs. Treatment</th>
<th>Control vs. Treatment</th>
<th>P - Positive</th>
<th>N - Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lord et al (222)</td>
<td>Cervical P, PC, RA</td>
<td>24</td>
<td>N/A</td>
<td>N/A</td>
<td>58%</td>
</tr>
<tr>
<td>Van Kleef, et al (247)</td>
<td>Lumbar P, DB, RA</td>
<td>31</td>
<td>38% vs. 67%</td>
<td>25% vs. 66%</td>
<td>19% vs. 47%</td>
</tr>
<tr>
<td>Dreyfuss et al (235)</td>
<td>Lumbar P</td>
<td>15</td>
<td>N/A</td>
<td>87%</td>
<td>80%</td>
</tr>
<tr>
<td>Gallagher et al (230)</td>
<td>Lumbar P, PC</td>
<td>30</td>
<td>17% vs. 42%</td>
<td>N/A</td>
<td>24% vs. 41%</td>
</tr>
<tr>
<td>North et al (228)</td>
<td>Lumbar R</td>
<td>40</td>
<td>N/A</td>
<td>N/A</td>
<td>13%</td>
</tr>
<tr>
<td>Skafter (172)</td>
<td>Cervical R</td>
<td>64</td>
<td>63%</td>
<td>63%</td>
<td>N/A</td>
</tr>
<tr>
<td>Schaerer (229)</td>
<td>Cervical R</td>
<td>50</td>
<td>N/A</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>Schaerer (229)</td>
<td>Lumbar R</td>
<td>71</td>
<td>N/A</td>
<td>35%</td>
<td>35%</td>
</tr>
<tr>
<td>Barton (240)</td>
<td>Lumbar R</td>
<td>126</td>
<td>N/A</td>
<td>67%</td>
<td>67%</td>
</tr>
<tr>
<td>Mirone and Somerville (113)</td>
<td>Lumbar P</td>
<td>29</td>
<td>79%</td>
<td>79%</td>
<td>79%</td>
</tr>
</tbody>
</table>

P - Prospective  PC - Placebo Controlled  RA - Randomized  R - Retrospective  DB - Double Blind
comprehensive data are available for percutaneous radiofrequency neurotomy for chronic cervical facet joint-mediated pain. A multitude of other uncontrolled reports of percutaneous radiofrequency neurotomy in the cervical spine also are encouraging (Table 2).

**Epidural Injections:** Approaches available to access the epidural space are interlaminar (cervical, thoracic, and lumbar), transforaminal (cervical, thoracic, lumbar, and sacral), and caudal (2-4, 274-276). The perceived advantages of each of the three approaches include (2-4, 277-282):

1. The interlaminar entry is directed more closely to the assumed site of pathology, facilitating delivery of the injectate directly to its target and requiring less volume;
2. The caudal entry is relatively easily achieved, with minimal risk of inadvertent dural puncture; and
3. The transforaminal approach is target specific in fulfilling the aim of reaching the primary site of pathology.

The disadvantages of each of the three approaches include:

1. With caudal entry:
   - The necessity of injection of a substantial volume of fluid (2, 4, 278, 282);
   - Unrecognized placement of the needle outside the epidural space in a substantial number of cases (2, 4, 284, 282-288);
2. With interlaminar entry, at the cervical, thoracic, or lumbar levels:
   - Extradural placement of the needle may go unrecognized without fluoroscopic guidance (2, 4, 278, 286, 288);
   - It is possible that one may erroneously miss the targeted interspace by one or two levels without fluoroscopic guidance, specifically in the thoracic and lumbar regions (2, 288, 290);
   - It may be necessary to position the needle one level below the site of suspected pathology due to preferential cranial flow of solutions in the epidural space (2, 289, 290);
3. With transforaminal entry:
   - Potential risk of intraneural injection and neural trauma.

Effectiveness of epidural injections has been evaluated in numerous studies (2-12, 124, 168, 271-281, 298-347). However, well-controlled randomized studies only exist for lumbar interlaminar epidural injections and caudal epidural injections. Most of these studies were performed by multiple specialty groups (rarely including pain specialists) and without radiographic control, except for transforaminal blocks. Epidural injections are used in management of various types of spinal pain, reflex sympathetic dystrophy, neuropathic pain, and postherpetic neuralgia (Tables 3 and 4). The studies in managing spinal stenosis have also had mixed results, with good results from caudal epidural steroid injections and poor results from lumbar interlaminar epidural injections.

Thus far, published evidence is balanced for caudal epidural steroids (2, 4, 5, 274, 313), but does not support the use of blind interlaminar lumbar epidural steroids (2, 4, 5, 12, 274, 274, 281, 288, 302, 313), cervical epidural steroids (3, 4), or injection of morphine unequivocally in the management of chronic spinal pain. Evidence for transforaminal steroids, though encouraging, is not extensive (2, 4, 5, 277, 313, 341-347). Hence, a strong argument can be made for transforaminal epidural injections. In review of 13 trials meeting strict inclusion criteria, 5 studies involving caudal epidural steroids injections and 8 studies involving lumbar epidural steroid injections were reviewed (12). This evaluation showed that in evaluating the effi-
ciency of caudal epidural injections, four studies were positive, whereas one was negative. However, for lumbar epidural injections, five out of eight studies showed negative response. The literature available on usage of cervical epidural steroids by interlaminar route is encouraging. However, all these studies were uncontrolled and retrospective in nature. The evidence for transforaminal epidural steroids is encouraging, though not overwhelming. Based on the pathophysiology of spinal pain, the rationale, and principle of delivering the medication to the site of pathology, the only appropriate method of choice in administering epidural steroid injections appears to be under fluoroscopy (2-5, 277, 278, 282-291, 313, 341-348).

Percutaneous Epidural Adhesiolysis: Percutaneous non-

<table>
<thead>
<tr>
<th>Study</th>
<th>Initial Relief Control vs. Treatment</th>
<th>Long-term Relief Control vs. Treatment</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breivik et al (328)</td>
<td>3-4 weeks (%) 3 months 6 months</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Bush &amp; Hiller (329)</td>
<td>25 vs. 63 20 vs. 50 20 vs. 50</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Yates (333)</td>
<td>100 N/A 64 vs. 83</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Beltiveau (334)</td>
<td>70 vs. 75 N/A</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Goebert et al (168)</td>
<td>N/A 72</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>

P = Prospective; R = Retrospective; C = Controlled; PC = Placebo controlled; RA = Randomized; DB = Double-blind; LA = Local anesthetic; S = Steroids; NS = Normal saline; N/A = Not available

Table 3. Results of published reports on caudal epidural steroid injections

<table>
<thead>
<tr>
<th>Study</th>
<th>Initial Relief Control vs. Treatment</th>
<th>Long-term Relief Control vs. Treatment</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dilke et al (300)</td>
<td>3-4 weeks (%) 3 months 6 months</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Ridley et al (303)</td>
<td>31 vs. 60 74 vs. 91 N/A</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Snoek et al (306)</td>
<td>19 vs. 90 19 vs. 90 65</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Carette et al (124)</td>
<td>25 vs. 33 N/A N/A</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Berman et al (307)</td>
<td>29 vs. 33 No sign. diff. No sign. diff.</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Rosen et al (315)</td>
<td>N/A 70% 61</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Warr et al (309)</td>
<td>60 N/A 24</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Swardlow and Sayle-Creer (281)</td>
<td>63 63 63</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Jamison et al (316)</td>
<td>52 vs. 67 N/A N/A</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Cackler et al (299)</td>
<td>62 62 62</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Harley (312)</td>
<td>26 vs. 40 N/A 13 vs. 26</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Rogers et al (318)</td>
<td>N/A 66 66</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>

P = Prospective; R = Retrospective; C = Controlled; PC = Placebo controlled; RA = Randomized; DB = Double-blind; LA = Local anesthetic; S = Steroids; N/A = Not available; NS = Normal saline

Table 4. Results of published reports on lumbar epidural steroid injections

Pain Physician Vol. 3, No. 1, 2000
endoscopic adhesiolysis and injection of hypertonic saline in the lumbar spine, its utilization and its studies have been reasonable and acceptable (349-360) (Tables 5 and 6). This modality of treatment appears to be reasonable in the management of refractory low back pain secondary to failed back surgery, disc disruption, and multilevel degenerative arthritis, even though there are a few detractors (360, 361).

Percutaneous epidural endoscopic adhesiolysis is also indicated for patients suffering with refractory low back pain secondary to a multitude of causes including post lumbar laminectomy syndrome, lumbar epidural fibrosis, and multilevel disc disruption, or multilevel degenerative arthritis (359, 362-364). However, this should only be used after the failure of the conservative modalities of treatments including caudal and transforaminal epidural injections. When available, epidural endoscopy should be the procedure of choice for lumbar epidural fibrosis.

Discography and Annuloplasty: Indication for disc injection and thermoneurolysis is a positive stimulation and analgesic response in the cervical spine and a positive disc stimulation in the lumbar spine (365-376). Evidence for thermal annuloplasty in the lumbar spine at the present time is equivocal and in its infancy (377-388). Currently, there is no role for intradiscal thermoneurolysis in the cerv-

Table 5. Results of published reports of percutaneous lysis of adhesions and hypertonic saline neurolysis for a single procedure

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Study Characteristics</th>
<th>No. of Patients</th>
<th>Drugs Used</th>
<th>No. of Days of Procedure</th>
<th>Initial Relief 1-4 weeks</th>
<th>3 months</th>
<th>6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Racz and Holubec (350)</td>
<td>R, RA</td>
<td>72</td>
<td>B, T, H, HS</td>
<td>3</td>
<td>65%</td>
<td>43%</td>
<td>13%</td>
</tr>
<tr>
<td>Arthur et al (355)</td>
<td>R</td>
<td>50</td>
<td>B, T, HS</td>
<td>3</td>
<td>68%</td>
<td>N/A</td>
<td>14%</td>
</tr>
<tr>
<td>Arthur et al (355)</td>
<td>R</td>
<td>50</td>
<td>B, T, H, HS</td>
<td>3</td>
<td>82%</td>
<td>N/A</td>
<td>12%</td>
</tr>
<tr>
<td>Manchikanti et al (356)</td>
<td>R, RA</td>
<td>103</td>
<td>M, L, HS</td>
<td>2</td>
<td>74%</td>
<td>37%</td>
<td>21%</td>
</tr>
<tr>
<td>Manchikanti et al (356)</td>
<td>R, RA</td>
<td>129</td>
<td>M, L, HS</td>
<td>1</td>
<td>79%</td>
<td>26%</td>
<td>14%</td>
</tr>
<tr>
<td>Manchikanti et al (359)</td>
<td>R</td>
<td>60</td>
<td>L, HS, CS</td>
<td>1</td>
<td>100%</td>
<td>25%</td>
<td>10%</td>
</tr>
</tbody>
</table>

R = Retrospective; RA = Randomized; B = Bupivacaine; L = Lidocaine; T = Triamcinolone; M = Methylprednisolone; CS = Celestone Soluspan; H = Hyaluronidase; HS = Hypertonic Saline; NS = Normal Saline

Table 6. Results of 1-year follow-up of patients percutaneous lysis of adhesions

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Study Characteristics</th>
<th>No. of Patients</th>
<th>No. of Days of Procedure</th>
<th>Percent of Patients with Significant Relief</th>
</tr>
</thead>
<tbody>
<tr>
<td>Racz et al (357) and Heavner et al (358)</td>
<td>P, C, RA</td>
<td>59</td>
<td>3</td>
<td>1 month 3 months 6 months 12 months</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>83% 49% 43% 49%</td>
</tr>
<tr>
<td>Manchikanti et al (359)</td>
<td>R</td>
<td>60</td>
<td>1</td>
<td>100% 90% 72% 52%</td>
</tr>
</tbody>
</table>

R = Retrospective; P = Prospective; RA = Randomized; C = Controlled
There is no consensus among the interventional pain management specialists with regards to type, dosage, frequency, total number of injections, or other interventions (2-13, 389). Yet significant attention in the literature seems to be focused on the complications attributed to the use of epidural steroids in the entire arena of interventional pain management. Thus, various limitations of interventional techniques, specifically neural blockade, have arisen from basically false impressions. Based on the available literature and scientific application, the most commonly used formulations of long-acting steroids, which include methylprednisolone (Depomedrol®), triamcinolone diacetate (Aristocort®), triamcinolone acetonide (Kenalog®), and betamethasone acetate and phosphate mixture (Celestone Soluspan®) appear to be safe and effective (Table 7). The safety of the steroids and the preservatives at epidural therapeutic doses has been demonstrated in both clinical and experimental studies. Based on the present literature, it appears that if repeated within two weeks, betamethasone probably would be the best in avoiding side effects; whereas if treatment is carried out at six-week intervals or longer, any one of the four formulations will be safe and effective.

Frequency and total number of injections or interventions are a key issue, although controversial and rarely addressed. Some authors recommend one injection for diagnostic as well as therapeutic purposes; others advocate three injections in a series irrespective of the patient’s progress or lack thereof; still others suggest three injections followed by a repeat course of three injections after 3-, 6-, or 12-month intervals; and, finally, there are some who propose an unlimited number of injections with no established goals or parameters. Limitation of 3 mg/kg of body weight of steroid or 210 mg per year in an average person and a lifetime dose of 420 mg of steroid, equivalent to methylprednisolone (Depomedrol) also have been advocated. While some investigators recommend one injection and do not repeat if there has been no response to the first, others recommend one or two more injections in the absence of response to the first injection. Some authors have reported good pain relief in previously unresponsive patients after an additional one or two injections. Similarly, some have believed that more than three injections do not result in additional improvement (308), whereas, others have reported the use of 6 to 10 injections if they are of benefit, however not to exceed 3 if they are not beneficial (390, 391). Such descriptions for other interventional techniques have been extrapolated from the limitations described for epidural steroid injections, even though there is no scientific basis or justification for such an extrapolation. It also has been shown in a multitude of publications that relief following multiple injections or interventions demonstrated a staircase-type phenomenon, even though it reached a plateau after three to four interventions.

### Outcomes and Cost Effectiveness

Outcomes may be assessed by evaluation of the quality of life, which is also known as functional status, health status, health-related quality of life; well-being of

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**Table 7. Pharmacologic profile of commonly used steroids**

<table>
<thead>
<tr>
<th>Name of the Drug</th>
<th>Equivalent Dose</th>
<th>Epidural Dose</th>
<th>Anti-inflammatory Potency</th>
<th>Sodium Retention Capacity</th>
<th>Duration of Adrenal Suppression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methylprednisolone acetate (Depo-Medrol)</td>
<td>4 mg</td>
<td>40-80 mg</td>
<td>5</td>
<td>0</td>
<td>2-6 weeks</td>
</tr>
<tr>
<td></td>
<td>0.6 mg</td>
<td>6-12 mg</td>
<td>25</td>
<td>0</td>
<td>1-2 weeks</td>
</tr>
<tr>
<td></td>
<td>4 mg</td>
<td>40-80 mg</td>
<td>5</td>
<td>0</td>
<td>1-2 weeks</td>
</tr>
<tr>
<td></td>
<td>4 mg</td>
<td>40-80 mg</td>
<td>5</td>
<td>0.5</td>
<td>1-6 weeks</td>
</tr>
</tbody>
</table>

Adapted from Manchikanti (186)
IM = Intramuscular; N/A = Not Available
the patient, satisfaction with care, health services utilization/economic analysis, and medical findings (392-400). The quality-of-life assessment is designed to evaluate the patient’s abilities to function in his/her own world. Physical functioning measures the ability to perform physical activities such as walking, climbing stairs, or carrying things. Evaluation focuses on the patient’s major perceived functional impairments, improvement in areas such as playing with children/grandchildren, having sexual relations, returning to work, going to school, homemaking or performing other activities of daily living. Quality of life also measures social functioning, which determines whether health problems affect normal social activities, such as seeing friends or participating in group activities.

It was shown that a simple reduction of diastolic pressure from 110 to 90 mm Hg was achieved at a cost of $16,330 for a 60 year-old man in 1974 (392). Costs of inpatient chronic pain programs range from $17,000 to $25,000, and the cost of outpatient treatment programs range from $7,000 to $10,000 (394). In addition, chronic pain patients may incur health care bills in excess of $20,000 annually for repetitive and in some cases redundant diagnostic work-ups, physical therapy, psychological interventions, and drugs. The effectiveness of a multitude of interventions in managing chronic pain and improving functional outcomes has not been demonstrated as yet (2, 3, 11-14, 17, 50, 71, 102-108, 140, 150, 151, 154, 193-215, 402, 403). In a recent study, Guo and colleagues (404) estimated that back pain accounted for 150 million lost work days in the United States every year, which worked out to be about $14 billion in wage costs alone. This study showed that the magnitude of the back pain problem is so large that even a 1% reduction in overall prevalence could considerably reduce morbidity and save billions of dollars. The cost-effectiveness of lumbar discectomy for the treatment of herniated intervertebral discs has been based on the conclusion that surgery increased the average quality-adjusted life expectancy by 0.43 years during the decade following treatment compared to conservative treatment, a result comparable to extending a healthy life by 5 months (194). It was also concluded that, for carefully selected patients with herniated discs, surgical discectomy is a cost-effective treatment at a discounted cost of $12,000 per discectomy or $29,000 per life year adjusted for quality (194). However, this study did not take into consideration the chronic pain patients when initial surgical treatment for herniated
disc fails. In such a study, it was shown that the success of a second operation was 50%, with an additional 20% considering themselves worse after the surgery (133). With a third procedure, the success rate was 30% with 25% considering themselves worse; and after four operations, only a 20% success rate was achieved, with 45% of these patients considering themselves worse (133). Hence, if additional costs of repeat surgery are taken into consideration, the cost of lumbar surgery will probably be much higher. Mueller-Schwefe and colleagues (405), in evaluating cost effectiveness of intrathecal therapy for pain secondary to failed back surgery syndrome, compared alternative therapies for achieving a defined outcome, reporting the cost of medical management to be $85,186 per 5 years, $17,037 per year, and $1,420 per month. They also showed that intrathecal morphine delivery resulted in lower cumulative 60-month costs of $82,893 per 5 years, $16,579 per year, and $1,382 per month.

Evaluation of caudal, interlaminar, and transforaminal steroid injections for the management of low back pain revealed surprising results, with cost effectiveness of caudal epidural steroids at $3,635 and transforaminal steroids at $2,927 per year, whereas interlaminar or lumbar epidural steroids were not shown to be cost effective at a cost of $6,024 per year (313). Cost effectiveness of percutaneous nonendoscopic adhesiolysis and hypertonic saline neurolysis, and percutaneous endoscopic adhesiolysis was demonstrated to be $5,564 and $8,127 respectively for improvement of 1 year of quality of life for patients with chronic low back pain nonresponsive to numerous other modalities of treatment (356). It was $2,028

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**Fig. 3. Suggested algorithm for comprehensive evaluation and management of chronic pain**

<table>
<thead>
<tr>
<th>History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain history</td>
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<tr>
<td>Medical history</td>
</tr>
<tr>
<td>Psychosocial history</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Assessment</th>
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<tbody>
<tr>
<td>Physical</td>
</tr>
<tr>
<td>Functional</td>
</tr>
<tr>
<td>Psychosocial</td>
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<tr>
<td>Diagnostic testing</td>
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</table>

<table>
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<tr>
<th>Impression</th>
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<table>
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<th>Management plan</th>
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<table>
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<tr>
<th>Alternatives</th>
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<table>
<thead>
<tr>
<th>Diagnostic interventions</th>
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</table>

<table>
<thead>
<tr>
<th>Therapeutic interventional management</th>
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<table>
<thead>
<tr>
<th>Reevaluation</th>
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<table>
<thead>
<tr>
<th>Persistent pain</th>
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<tbody>
<tr>
<td>New pain</td>
</tr>
<tr>
<td>Worsening pain</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adequate pain relief and improvement in functional status</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Discharge or maintain</th>
</tr>
</thead>
</table>

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*Pain Physician Vol. 3, No. 1, 2000*
with nonendoscopic and $7,020 with endoscopic adhesiolysis in post lumbar laminectomy patients (359). Hence, it appears that neural blockade and other interventional techniques are cost effective if performed properly, as shown in Fig. 2.

### CLINICAL ALGORITHM

The clinical algorithms presented on the following page show an effort to blend conscientious, explicit, and judicious use of the current best evidence in making decisions about the care of individual patients. When this is combined with the clinician’s experience and judgment, and patient preferences, it should result in improved outcomes and significantly improved quality of care.

The following criteria should be considered carefully in performing interventional techniques:

1. Complete initial evaluation including history and physical examination.
2. Physiological and functional assessment, as necessary and feasible.

Definition of indications and medical necessity:

- **Suspected organic problem.**
- **Nonresponsiveness to conservative modalities of treatments except in acute situations such as acute disc herniation, herpes zoster and postherpetic neuralgia, reflex sympathetic dystrophy, and intractable pain secondary to carcinoma.**
- **Pain and disability of moderate-to-severe degree.**
- **No evidence of contraindications such as severe spinal stenosis resulting in intraspinal obstruction, infection, or predominantly psychogenic pain.**
- **Responsiveness to prior interventions with improvement in physical and functional status for repeat blocks or other interventions.**
- **Repeating interventions only upon return of pain and deterioration in func-
tional status.

**DIAGNOSTIC BLOCKS**

Diagnostic blockade of a structure with a nerve supply which can generate pain can be performed to test the hypothesis that the target structure is a source of the patient’s pain (14). Testing the hypothesis by provoking pain in any structure is an unreliable criterion except in provocative discography (85). However, relief of pain is the essential criterion in almost all structures including analgesic discography in the cervical spine, the only deviation being lumbar discs (14). If the pain is not relieved, the source may be in another structural component of the spine similar to the one tested such as a different facet joint or a different nerve root or some other structure (14). Salient features of somatic and radicular pain are described in Fig. 4. However, one should bear in mind the short comings and pitfalls inherent in the conventional evaluation of spinal pain (Fig. 2).

When the source of pain is more than one structure or multiple levels, it is not expected that all the pain will be relieved. For example, there may be painful facet joints bilaterally at a given segmental level, in which case anesthetizing the left joint should relieve the left side, but not the right side; there may be pain from two consecutive joints on one side, in which case anesthetizing the lower joint alone may relieve only the lower half of the pain; there may be more than one structure involved, such as pain contributed by discs and facet joints or facet joints and nerves (14).

True positive responses are secured by perform-
ing controlled blocks. Ideally, this should be in the form of placebo injections of normal saline, but logistic and ethical considerations prohibit the use of normal saline in conventional practice.

In contrast to utilizing placebo blocks, a convenient control is the use of comparative local anesthetic blocks in which on two separate occasions the same structure is anesthetized, but using local anesthetic with different durations of action. However, one of the drawbacks of local anesthetic control is that comparative local anesthetic blocks may not be implementable for intra-articular blocks, for it is not known whether placement of local anesthetic in a relatively avascular environment such as a joint space affects its expected duration of action. However, these are implemented readily for medial branch blocks and probably for other types of nerve blocks. With medial branch blocks, the use of comparative local anesthetic blocks has been validated and found to be valid against challenge with placebo (14, 407-409).

Double blocks with comparative local anesthetics are required, as a diagnosis cannot be rendered reliably on the basis of a single block because false-positive rates are seen in as many as 41% of patients (14, 111, 112, 407). Thus, controlled blocks are recommended in essen-
It may be essential to combine, in certain circumstances, more than one block. This may include an epidural for the cervical region and facet-joint blocks for the lumbar region; epidural and facet-joint blocks for the same region are indicated when pain generators from both sources have been identified; a sympathetic block and facet-joint block are indicated if there are two different sources of pain or if two different regions are affected in combination with trigger-point injections.

It is recommended that a physician should consider a patient in totality and treat multiple regions of the patient in the same setting, as long as it is safe and feasible. Attempts to treat one particular organ at a different time is not an absolute necessity. However, no more than five procedures (different procedures and/or multiples of one procedure - or total line items of procedures) should be billed in one setting for any of the following: the procedures are performed in different regions or a combination of procedures in one or multiple regions. For treatment of a single region (eg. only lumbosacral spine or cervical spine) a maximum of four (different procedures and/or multiple of one procedure - or total line items of procedures) procedures should be billed.

THERAPEUTIC INTERVENTIONAL TECHNIQUES

The rationale for therapeutic interventional techniques is based on the fact that, when a particular structure is determined to be the source, long-term relief can be sought by directing therapeutic interventions at that structure. These include facet joints, neural structures, sympathetic ganglion, and peripheral nerves.

The review of the rationale and indications precedes this discussion and is included under neural blockade.

Frequency and Number of Injections or Interventions

In the diagnostic and stabilization phase, a patient may receive injections at intervals of no sooner than 1 week and preferably 2 weeks for most types of blocks except for blockade in cancer pain or when a continuous administration of sympathetic blocks is employed.

In the treatment phase (after the stabilization is completed), the frequency of interventional techniques should be 2 months or longer between each injection provided that at least >50% relief is obtained for 6 weeks. However, if the neural blockade is applied for different regions, they can be performed at intervals of no sooner than 1 week and preferably 2 weeks for most type of blocks. The therapeutic frequency must remain 2 months for each region. It is further suggested to treat all regions at the same time provided all procedures are performed safely.

In the stabilization phase, the number of injections should be limited to no more than four times per year in cases of all the blocks except sympathetic blocks, in which case six times should be reasonable.

In the maintenance phase, the interventional procedures should be repeated only as necessary judging by the medical necessity criteria and these should be limited to a maximum of six times for local anesthetic and steroid blocks and four times for interventions such as radiofrequency thermoneurolysis, and cryoneurolysis for a period of one year.

For percutaneous non-endoscopic adhesiolysis with a 3-day protocol, 2-3 interventions per year are recommended; with a 1-day protocol, a maximum of 6 times per year is recommended.

For endoscopic adhesiolysis, it is recommended that there be no more than 2-3 interventional procedures per year.

Under unusual circumstances with a recurrent injury, carcinoma, cervicogenic headache, or regional sympathetic dystrophy, blocks may be repeated at intervals of 6 weeks after stabilization in the treatment phase.

Combination of Blocks/Interventions

It may be essential to combine, in certain circumstances, more than one block. This may include an epidural for the cervical region and facet-joint blocks for the lumbar region; epidural and facet-joint blocks for the same region in case of identification of pain generators from
both sources; a sympathetic block and facet-joint block if there are two different sources of pain or if two different regions are affected in combination with trigger-point injections. Consequently, blocks also may be combined with other interventional techniques.

Number Per Setting

It is recommended that a physician should consider a patient in totality and treat multiple regions of the patient in the same setting, as long as it is safe and feasible. Attempts to treat one particular organ at a different time are not an absolute necessity.

However, no more than five procedures (different procedures and/or multiples of one procedure - or total line items or procedures) must be billed in one setting for any of the following: the procedures are performed in different regions or a combination of procedures in one or multiple regions. For treatment of a single region (e.g., only lumbosacral spine or cervical spine) a maximum of four procedures (different procedures and/or multiples of one procedure - or total line items or procedures) should be billed.

SPECIFIC INTERVENTIONAL TECHNIQUES

Diagnostic and Procedure Coding

The following description of specific interventional techniques includes disease descriptions with ICD-9-CM codes (410), and procedure codes of CPT™ 1999 and 2000 (411, 412).

Facet Joint Blocks and Neurolysis

Facet joints are paired joints extending from the cervical spine through the lumbosacral spine. Due to the functional and structural relationship of atlanto-axial, atlanto-occipital, and sacroiliac joints, the blockade of these joints is also included in facet joints. However, neurolysis is not yet established for the joints other than facet joints per se (e.g., not for atlanto-axial joint).

- There is no evidence that facet joint-mediated pain, either in the cervical region, thoracic region, or lumbosacral region, can be diagnosed by clinical examination, or by medical imaging.
- It is generally agreed upon that controlled diagnostic blocks are the only means available of identifying the source of facet joint-mediated pain.

Controlled studies have shown that facet joint pain contributes to 15% to 40% in the lumbar spine and over 50% in the cervical spine.

Any of the spinal joints can be anesthetized either with intra-articular injections of local anesthetic or by anesthetizing the medial branches of the dorsal rami that innervate the target joint or the nerve supply to atlanto-axial, atlanto-occipital, and sacroiliac joints.

If pain is not relieved, the joint cannot be considered the source of pain and the source may be either another facet joint or some other structure.

If the pain is relieved, the joint may be considered to be the source of pain. However, false-positive responses must be ruled out, which may be seen in almost 40% of the patients.

- All the patient’s pain need not be relieved, for it is possible that a patient may have several sources of pain.
- Comparative local anesthetic blocks, in which on two separate occasions the same joint is anesthetized, but using local anesthetics with different durations of action or placebo blocks.
- Comparative local anesthetic blocks may not be implementable for intra-articular blocks, but are readily implemented if medial branch blocks are used.
- A true positive response confirms that the joint is the source of the pain, with a confidence of 85%.

It is recognized that it may be necessary to provide additional blocks in conjunction with facet-joint blocks such as selective nerve root or selective epidural blocks and disc injections. It is also recognized that multiple levels of facet-joint blocks may be performed in one setting, either in the same region or in multiple regions, more commonly than not.

Facet joint denervation is based on the outcome of a diagnostic facet-joint nerve block, with the patient obtaining sufficient relief for a meaningful period of time, but when pain recurs, a repeat block utilizing a small dose of local anesthetic and steroid does not provide longer-lasting relief. This is performed either by injecting neuro-

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lytic substance or by denervation utilizing radiofrequency thermoneurolysis or cryoneurolysis.

If facet joint-mediated pain is present in conjunction with radiculopathy, both ailments should be managed.

Procedure (CPT) Codes:

1999 Codes (411)

- 64442 - Injection, anesthetic agent; paravertebral facet-joint nerve block, lumbar, single level
- 64443 - Injection, anesthetic agent; paravertebral facet-joint nerve block, lumbar, each additional level
- 64622 - Destruction by neurolytic agent, paravertebral facet-joint nerve, lumbar, single level
- 64623 - Destruction by neurolytic agent, paravertebral facet-joint nerve, lumbar, each additional level

2000 Codes (412)

- 64470 - Injection, anesthetic agent and/or steroid, paravertebral facet-joint or facet-joint nerve, cervical or thoracic, single level
- 64472 - Injection, anesthetic agent and/or steroid, paravertebral facet-joint or facet-joint nerve, cervical or thoracic, each additional level
- 64475 - Injection, anesthetic agent and/or steroid, paravertebral facet joint or facet joint nerve, lumbar or sacral, single level
- 64476 - Injection, anesthetic agent and/or steroid, paravertebral facet-joint or facet-joint nerve, lumbar or sacral, each additional level
- 64626 - Destruction by neurolytic agent, paravertebral facet-joint nerve; cervical or thoracic, single level
- 64627 - Destruction by neurolytic agent, paravertebral facet-joint nerve; cervical or thoracic, each additional level
- 64622 - Destruction by neurolytic agent, paravertebral facet-joint nerve; lumbar or sacral, single level
- 64623 - Destruction by neurolytic agent, paravertebral facet-joint nerve; lumbar or sacral, each additional level
- 27096 - Injection procedure for sacroiliac joint, arthrography and/or anesthetic/steroid
- 73542 - Radiological examination, sacroiliac joint arthrography, radiological supervision and interpretation

76005 - Fluoroscopic guidance and localization of needle or catheter tip for spine or paraspinous diagnostic or therapeutic injection procedures (epidural, transforaminal epidural, subarachnoid, paravertebral facet joint, paravertebral facet joint nerve or sacroiliac joint), including neurolytic agent destruction

Diagnostic (ICD9) Codes (410)

1. Spondylosis without myelopathy, dorsal arthritis, osteoarthritis, and spondyloarthritis (facet-joint arthropathy) 721.0 cervical, 721.2 thoracic, 721.3 lumbar, 720.2 sacroiliitis, and 721.7 traumatic spondylopathy
2. Post laminectomy syndrome: 722.81 cervical; 722.82 thoracic; 722.83 lumbar
3. Degeneration of intervertebral disc, including narrowing of disc space 722.4 cervical, 722.51 thoracic, 722.52 lumbar
4. Strain 847.0 cervical, 847.1 thoracic, 847.2 lumbar
5. Torticollis 754.1 congenital, 333.83 spasmodic, 347.0, traumatic
6. Spondylolysis 756.11 congenital, 738.4, acquired
7. Spondylolisthesis 756.12 congenital, 738.4 acquired

Epidural Injections

Epidural injections are used both for diagnostic and therapeutic purposes. Epidural injections are performed in the cervical region, thoracic region, and lumbosacral region. Epidural injections are performed by various means:

- Interlaminar (cervical, thoracic, and lumbar)
- Transforaminal (cervical, thoracic, lumbar, and sacral)
- Caudal

Procedure (CPT) Codes:

1999 Codes (411)

- 62275 - Injection of diagnostic or therapeutic anesthetic or antispasmodic substance (including narcotics); epidural, cervical or thoracic, single
- 62278 - Injection of diagnostic or therapeutic anesthetic or antispasmodic substance (including narcotics); epidural, lumbar or caudal, single
◆ 62279 - Injection of diagnostic or therapeutic anesthetic or antispasmodic substance (including narcotics); epidural, lumbar or caudal, continuous
◆ 62289 - Injection of substance other than anesthetic, antispasmodic, contrast, or neurolytic solutions; lumbar or caudal (separate procedure)
◆ 01996 - Daily management of epidural or subarachnoid drug administration
◆ 62284 - Injection procedure for myelography

2000 Codes (412)

◆ 62310 - Injection, single (not via indwelling catheter), not including neurolytic substances, with or without contrast (for either localization or epidurography), of diagnostic or therapeutic substance(s) (including anesthetic, antispasmodic, opioid, steroid, other solution), epidural or subarachnoid; cervical or thoracic
◆ 62311 - Injection, single (not via indwelling catheter), not including neurolytic substances, with or without contrast (for either localization or epidurography), of diagnostic or therapeutic substance(s) (including anesthetic, antispasmodic, opioid, steroid, other solution), epidural or subarachnoid; lumbar, sacral (caudal)
◆ 62318 - Injection, including catheter placement, continuous infusion or intermittent bolus, not including neurolytic substances, with or without contrast (for either localization or epidurography), of diagnostic or therapeutic substance(s) (including anesthetic, antispasmodic, opioid, steroid, other solution), epidural or subarachnoid; cervical or thoracic
◆ 62319 - Injection, including catheter placement, continuous infusion or intermittent bolus, not including neurolytic substances, with or without contrast (for either localization or epidurography), of diagnostic or therapeutic substance(s) (including anesthetic, antispasmodic, opioid, steroid, other solution), epidural or subarachnoid; lumbar, sacral (caudal)
◆ 64479 - Injection, anesthetic agent and/or steroid, transforaminal epidural; cervical or thoracic, single level
◆ 64480 - Injection, anesthetic agent and/or steroid, transforaminal epidural; cervical or thoracic, each additional level
◆ 64483 - Injection, anesthetic agent and/or steroid, transforaminal epidural; lumbar or sacral, single level
◆ 64484 - Injection, anesthetic agent and/or steroid, transforaminal epidural; lumbar or sacral, each additional level
◆ 72275 - Epidurography, radiological supervision and interpretation
◆ 76005 - Fluoroscopic guidance and localization of needle or catheter tip for spine or paraspinal diagnostic or therapeutic injection procedures (epidural, transforaminal epidural, subarachnoid, paravertebral facet joint, paravertebral facet joint nerve or sacroiliac joint), including neurolytic agent destruction

Diagnostic (ICD9) Codes (410)

1. Postlaminectomy syndrome
   ◆ 722.81 cervical, 722.82 thoracic, 722.83, lumbosacral
2. Disc displacement without myelopathy (disc herniation, radiculitis, disc extrusion, disc protrusion, disc prolapse, discogenic syndrome).
   ◆ 722.0 cervical, 722.11 thoracic, 722.10 lumbosacral
3. Disc displacement with myelopathy
   ◆ 722.71 cervical, 722.72 thoracic, 722.73 lumbosacral
4. Degeneration of intervertebral disc (includes narrowing of disc space)
   ◆ 722.4 cervical, 722.51 thoracic, 722.52 lumbosacral
5. 721.7 traumatic spondylolisthesis
6. Epidural fibrosis
   ◆ 349.2 cervical, 349.2 thoracic, 349.2 lumbosacral
7. Radiculitis
   ◆ 723.4 cervical, 724.4 thoracic, 724.4 lumbosacral
8. Spinal stenosis
   ◆ 723.0 cervical, 724.04 thoracic, 724.02 lumbosacral
9. Spondylosis with myelopathy (anterior/vertebral artery compression, spondylopathic compression of cord)
   ◆ 721.1 cervical, 721.41 thoracic, 721.42 lumbosacral
10. Facet arthropathy or spondylosis without myelopathy, dorsal arthritis, osteoarthritis, and spondyloarthritis
    ◆ 721.0 cervical, 721.2 thoracic, 721.3 lumbosacral
11. Strain
   ◆ 847.0 cervical, 847.1 thoracic, 847.2 lumbosacral
12. Plexus lesions (thoracic-outlet syndrome brachial plexus, lumbar plexus)
   ◆ 353.0 cervical, 353.1 lumbosacral
13. Root lesions (NES) neuritis
   ◆ 353.2 cervical, 353.3 thoracic, 353.4 lumbosacral
14. Closed fracture of spine
   ◆ 805.0 cervical, 805.2 thoracic, 805.4 lumbar, 805.6 sacral
15. Spina bifida
   ◆ 741.91 cervical, 741.92 thoracic, 741.93 lumbosacral
16. Spina bifida occulta
   ◆ 756.17 cervical, 756.17 thoracic, 756.17 lumbosacral
17. Congenital spondylolysis
   ◆ 756.11 cervical, 756.11 thoracic, 756.11 lumbosacral
18. Acquired/degenerative spondylolysis or acquired spondylolisthesis
   ◆ 738.4 cervical, 738.4 thoracic, 738.4 lumbosacral
19. Congenital spondylolisthesis
   ◆ 756.12 cervical, 756.12 thoracic, 756.12 lumbosacral
20. Rheumatoid arthritis 714.0
21. Coccygodynia 724.79
22. Sciatica 724.3
23. Complex regional pain syndrome (Type I or RSD)
   ◆ 337.20 RSD unspecified, 337.21 RSD upper limb, 337.22 RSD lower limb, 337.29 RSD other unspecified site
24. Complex regional pain syndrome (Type II or causalgia)
   ◆ 355.9 causalgia, 354.4 causalgia upper limb, 355.71 causalgia lower limb
25. Peripheral neuropathy
   ◆ 356.4 idiopathic, 356.0 hereditary, 357.2 diabetic, 357.5 alcoholic, 357.6 due to drug
26. Limb pain
   ◆ 353.6 phantom limb pain, 997.60 stump pain, 997.61 neuroma of amputation stump, 342.0 hemiplegia – flaccid, 342.1 hemiplegia – spastic
27. Postherpetic neuralgia
   ◆ 053.10 with unspecified nerve system complication
   ◆ 053.13 postherpetic polyneuropathy
28. Pain syndromes secondary to neoplasm 141.0 - 239.9
29. Vascular ischemic pain

**Percutaneous Lysis of Epidural Adhesions**

Percutaneous nonendoscopic epidural adhesiolysis utilizing a Racz® catheter can be performed in two ways. The original protocol requires epidurography; adhesiolysis; and injection of hyaluronidase, bupivacaine, triamcinolone diacetate, and sodium chloride solution on day 1 and injection of bupivacaine and hypertonic sodium chloride solution on days 2 and 3. The simplified and modified technique involves a 1-day procedure.

Percutaneous epidural endoscopic adhesiolysis is described as a minimally invasive technique for adhesiolysis and accurate placement of injectate into the epidural space.

**Procedure (CPT) Codes**

1999 Codes (411)

- 62281 - Injection of neurolytic substance (eg, alcohol, phenol, saline solutions); epidural, cervical or thoracic
- 62282 - Injection of neurolytic substance (eg, alcohol, phenol, saline solutions); epidural, lumbar or caudal
- 62284 - Injection procedure for myelography and/or computerized axial tomography, spinal (other than C1-2 and posterior fossa)
- 01996 - Daily management of epidural or subarachnoid drug administration
- 64714 - Neuroplasty, major peripheral nerve, lumbar plexus or 64722, decompression; unspecified nerve(s) or
- 64727 - Internal neurolysis, requiring use of operating microscope

2000 Code (412)

- 62263 - Percutaneous lysis of epidural adhesions using solution injection (eg, hypertonic saline, enzyme) or mechanical means (eg, spring-wire
catheter) including radiologic localization (includes contrast when administered)

**Diagnostic (ICD9) Codes (410)**

1. Postlaminectomy syndrome
   - 722.81 cervical, 722.82 thoracic, 722.83 lumbosacral
2. Epidural fibrosis 349.2
3. Disc displacement with myelopathy
   - 722.71 cervical, 722.72 thoracic, 722.73 lumbosacral
4. Disc displacement without myelopathy (disc herniation, radiculitis, disc extrusion, disc protrusion, disc prolapse, discogenic syndrome).
   - 722.0 cervical, 722.11 thoracic, 722.10, lumbosacral
5. Degeneration of intervertebral disc (includes narrowing of disc space)
   - 722.4 cervical, 722.51 thoracic, 722.52 lumbosacral

**Sympathetic Blocks and Neurolysis**

**Procedure (CPT) Codes (411, 412)**

A. Local anesthetic blocks
1. 64505 sphenopalatine ganglion block
2. 64510 injection, anesthetic agent; stellate ganglion (cervical sympathetic)
3. 64520 injection, anesthetic agent; lumbar or thoracic (paravertebral sympathetic)
4. 64530 injection, anesthetic agent; celiac plexus, with or without radiological monitoring

B. Neurolytic blocks
1. 64680 celiac plexus neurolytic block
2. A physician may use modifier 22 for:
   - Sphenopalatine ganglion
   - Stellate ganglion
   - Thoracic or lumbar paravertebral sympathetic

**Diagnostic (ICD9) Codes (410)**

1. Complex regional pain syndrome type I (RSD), type II (causalgia)
   - 337.20 RSD unspecified, 337.21 RSD upper limb, 337.22 RSD lower limb,
   - 337.29 RSD other unspecified site
   - 355.9 causalgia, 354.4 causalgia upper limb, 355.71 causalgia lower limb
   - Peripheral neuropathy
   - 356.4 idiopathic, 356.0 hereditary, 357.2 diabetic, 357.5 alcoholic, 357.6 due to drug
   - Limb pain
   - 353.6 phantom limb pain, 997.60 stump pain, 997.61 neuroma of amputation stump, 342.0 hemiplegia - flaccid, 342.1 hemiplegia - spastic
   - Plexus lesions
   - 353.0 thoracic outlet syndrome, 353.1 lumbar plexus lesions
   - Postherpetic neuralgia
   - 053.10 with unspecified nerve system complication, 053.11 geniculate herpes zoster, 053.12 postherpetic trigeminal neuralgia, 053.13 postherpetic polymyoneuropathy, 053.19 other, 053.12 herpes zoster dermatitis of upper eyelid, 053.21 herpes zoster keratoconjunctivitis, 053.22 herpes zoster iridocyclitis, 053.29 other ophthalmic complications
   - Pain syndromes secondary to neoplasm 141.0 - 239.9
   - Vascular ischemic pain
   - Headache
   - 346.01 intractable migraine with aura,
   - 346.11 intractable migraine without aura,
   - 346.21 intractable cluster,
   - 346.20 nonintractable cluster,
   - 346.9 unspecified migraine

**Intercostal Nerve Blocks and Neurolysis**

**Procedure CPT Codes (411, 412)**

- 64420 - Introduction / injection of anesthetic agent (nerve block), diagnostic or therapeutic, intercostal nerve, single.
- 64421 - Introduction / injection of anesthetic agent (nerve block), diagnostic or therapeutic, intercostal nerve, multiple.
- 64620 - Destruction by neurolytic agent; intercostal nerve.
- 64620-51 - Destruction by neurolytic agent, additional levels
1. 353.3 thoracic root lesions, not elsewhere classified (intercostal neuritis)
2. 353.8 other nerve root and plexus disorders
3. 353.9 unspecified nerve root and plexus disorder
4. 053.10 herpes zoster with unspecified nervous system complication
5. 053.13 post herpetic polyneuropathy
6. 114.02 - 239.9 pain syndromes secondary to neoplasm

**Trigeminal Nerve Block(s)**

Trigeminal nerve block with local anesthetic and steroid is utilized in managing pain or trigeminal neuralgia or cancer pain when pharmacological measures fail.

**Procedure (CPT) Codes (411, 412)**

- 64400 injection, anesthetic agent; trigeminal nerve, any division or branch.
- 64600 destruction by neurolytic agent, trigeminal nerve; supraorbital, infraorbital, mental, or inferior alveolar branch
- 64605 destruction by neurolytic agent, trigeminal nerve; second and third branches at foramen ovale
- 64610 destruction by neurolytic agent, trigeminal nerve; second and third division branches at foramen ovale under radiological monitoring

**Diagnostic (ICD-9) Codes (410)**

1. 350.1 trigeminal neuralgia
2. 350.2 atypical facial pain
3. 350.8 trigeminal neuralgia, specified
4. 350.9 trigeminal neuralgia, unspecified
5. 053.12 postherpetic trigeminal neuralgia

**Discography and Annuloplasty**

Even though riddled with controversy, disc stimulation and injections are used quite frequently for the purposes of diagnosis of discogenic syndrome, as well as prior to surgical intervention such as fusion. Intradiscal thermocoagulation with a catheter was introduced in 1998. Stringent standards of practice have been established to ensure that the results of discography are not polluted by false-positive responses.

**Procedure (CPT) Codes (411, 412)**

- 6290 injection procedure for discography, each level; lumbar
- 6291 injection procedure for discography, each level; cervical or thoracic

**Diagnostic (ICD-9) Codes (410)**

1. Disc displacement without myelopathy (disc herniation, radiculitis, extrusion, protrusion, prolapse, discogenic syndrome)
   - 722.0 cervical, 722.11 thoracic, 722.10 lumbosacral
2. Degeneration of intervertebral disc including narrowing of disc space
   - 722.4 cervical, 722.51, thoracic, 722.52 lumbosacral

**Trigger-Point Injections**

Myofascial trigger points are self-sustaining hyperirritative foci that may occur in any skeletal muscle in response to strain produced by acute or chronic overload.

**Procedure (CPT) Codes (411, 412)**

1. 20550, injection, tendon sheath, ligament, trigger points, or ganglion cyst.

**Diagnostic (ICD-9) Codes (410)**

1. 729.1 myalgia and myositis, unspecified
2. 729.0 rheumatism, unspecified and fibrocystitis

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