

Chapter 23

ACUTE PRESENTATIONS OF CHRONIC PAIN CONDITIONS

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INTRODUCTION

It is often assumed that battle-related injuries are the leading cause of hospitalization and medical evacuation during combat operations. In fact, as long as accurate figures have been maintained, injuries caused in combat have never been the leading reason for soldier attrition. In World War I, respiratory illness and infections were the most common reason for removal from the battlefield, with combat injuries in third place, and nonbattle injuries (NBIs) ranking fourth. In subsequent conflicts this order changed, and by the Vietnam War NBIs had become the leading cause of loss of personnel from the combat arena, which has continued to be the case into the present time.^{1,2}

Among NBIs, the conditions associated with the lowest return-to-duty (RTD) rates are psychiatric conditions, back pain, and other musculoskeletal conditions.³ A striking feature these conditions have in common is that the farther away from the battlefield they are treated, the less probability there is of successful RTD. With back pain and other musculoskeletal pains, studies have suggested that earlier intervention and treatment, as close to the parent unit as possible, may be associated with an increased RTD rate.⁴ For practical purposes, this chapter will deal mainly with common spinal and other musculoskeletal pains.

DEFINITION AND CLASSIFICATION OF PAIN

The International Association for the Study of Pain defines pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.⁵ Pain is generally classified as acute or chronic. Acute pain is a normal response to a physiological insult and serves several important functions. It is a protective mechanism that helps us survive in hostile environments. It serves as a warning sign of imminent danger, and also causes an individual to nurse or rest the affected body part, thus allowing it time to heal. Acute pain is therefore a symptom of an event or disease state.

In contrast, chronic pain serves no such purpose and is not normally associated with ongoing damage; the original physiological response has changed into a nonfunctional pain signal. Acute pain therefore ceases to be a symptom of a disease, and instead becomes a “disease” itself. Chronologically, pain that lasts beyond the usual time necessary for an injury to heal is considered chronic, generally accepted be less than 3 months, although some authorities maintain that 4 to 6 weeks is a more appropriate cutoff between acute and chronic pain.

Etiologically, pain can be classified as either nociceptive or neuropathic, although in reality there is significant overlap between the categories, and many conditions such as spinal pain share characteristics of both. Nociceptive pain refers to the pain that arises from noxious stimuli, and may be somatic or visceral. It is the result of actual or potential tissue damage, and would accurately describe postoperative pain. Somatic pain arising from tissue damage tends to be well localized, and is transmitted via fast myelinated A-δ nerve fibers and slower unmyelinated C fibers. Visceral pain, as the name suggests, arises from internal organs and is generally poorly localized due to convergence. In

contrast to neuropathic and somatic pain, it is more likely to be described as “dull, cramping, and deep.”

Nociceptors are specific for a variety of noxious stimuli, and include thermal, mechanical, and chemical receptors. A-δ fiber discharge is linearly related to the intensity of the stimulus. The response threshold, and the rate of firing to secondary-order neurons in the dorsal horn, allow afferent signals to be encoded in the central nervous system for processing. Wide dynamic range nociceptors respond to a continuum of stimuli

TABLE 23-1

CLINICAL FEATURES OF NEUROPATHIC PAIN

Clinical Feature	Presentation
Allodynia	Pain caused by stimulus that is not normally painful, eg, light touch, cold
Hyperalgesia	An exaggerated pain response to a normally painful stimulus
Dysesthesia	Altered sensations, eg, sensation of something crawling on the skin (formication)
Hyperpathia	Pain that may occur due to repeated innocuous or noxious stimuli, and which may even be present with sensory impairment
Pain quality	Often described as shooting, burning, or lancinating
Sensation	Frequently accompanied by sensory loss in the distribution of a dermatome or peripheral nerve
Temporal nature	May be paroxysmal or continuous

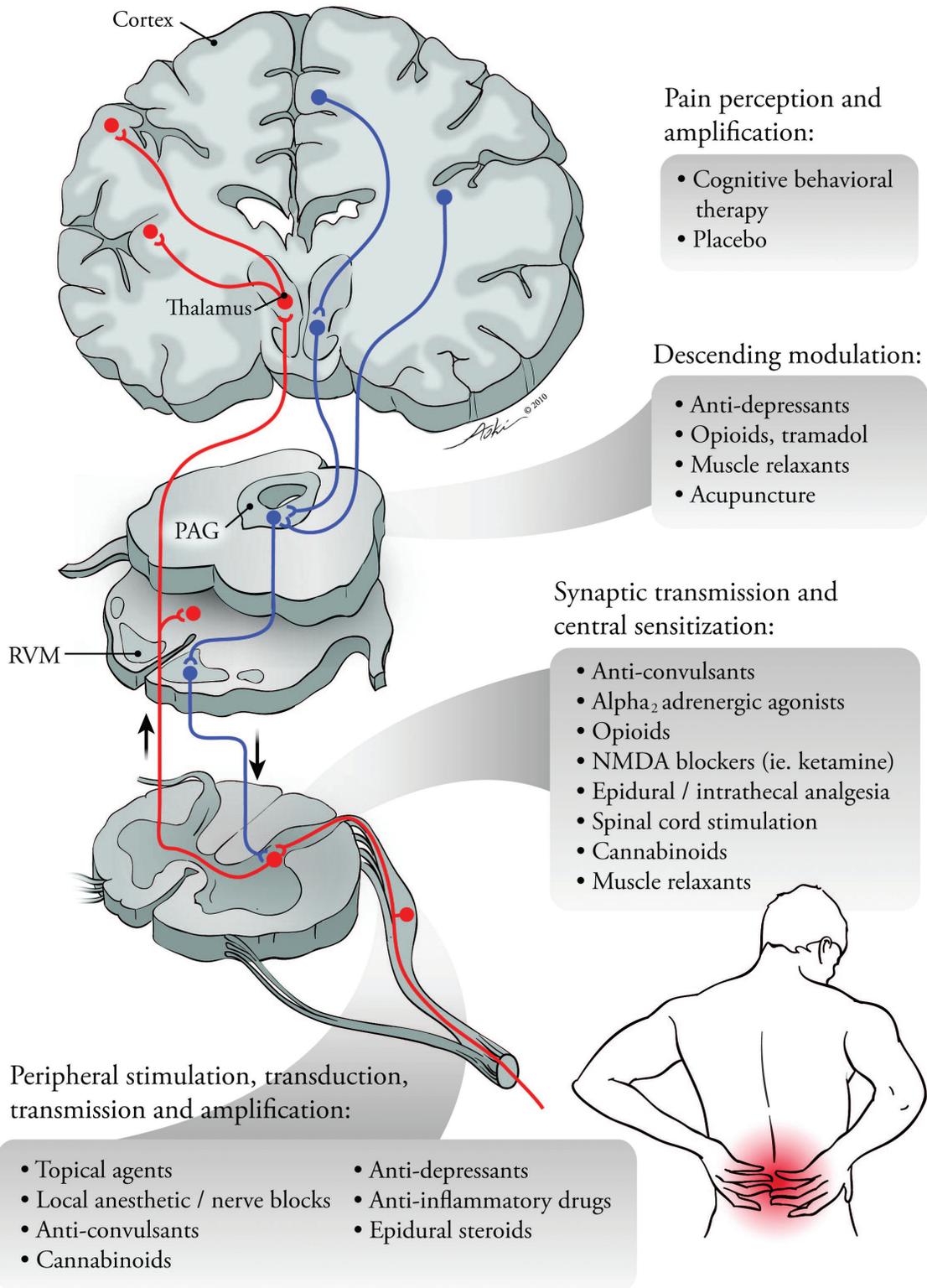


Figure 23-1. Ascending pain pathways (red) and descending modulation (blue), illustrating the sites of actions for various analgesic agents.

NMDA: N-methyl D-aspartate; PAG: periaqueductal grayplease; RVM: rostroventral medullaplease

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ranging from gentle warmth to tissue-damaging heat. With exposure to any noxious stimulus, a variety of nociceptors are stimulated in various degrees, and their output is summated to produce the subjective pain experience, which includes descending modulation and cognitive, emotional, and psychological input (Figure 23-1).

Neuropathic pain arises from damaged nervous tissue. The injury may occur anywhere along the nociceptive pathway (eg, the pain receptors, peripheral

nerves, spinal cord, or central regions of the brain). Neuropathic pain may result from a variety of pathological conditions, including inflammation, trauma, ischemia, and degenerative processes, and persists even in the absence of ongoing disease or physiological insult (eg, diabetic nephropathy). Neuropathic pain is frequently subdivided into peripheral neuropathic pain (eg, diabetic neuropathy) and central pain (eg, phantom pain or spinal cord injury). Table 23-1 lists clinical features of neuropathic pain.

BACK PAIN

In the civilian population, it is estimated that about 10% of consultations with primary care practitioners are related to musculoskeletal pain. The majority of these consultations involve back or spine pain.⁶ As one may expect, this problem is also common in the military population, and during training exercises and active deployments, the incidence of back pain rises even higher. About 75% of the consultations for spine pain in the military setting involve low back pain, with the remainder involving neck and mid-back pain problems.

In the civilian population, the strongest predictors for persistent back pain after an acute episode relate to lifestyle (eg, heavy physical activity, sedentary lifestyle, obesity, smoking); profession (eg, low job satisfaction); and psychosocial issues (eg, depression, anxiety, fear-avoidance behavior, poor coping skills, catastrophization [believing something is far worse than it is]). These factors are also present in military personnel and can be exacerbated by military-specific risk factors, such as inadequate support structures, lack of autonomy, concomitant psychological trauma, heavy combat loads, job-related sleep deprivation, austere living conditions, and high-impact landings during airborne, air-assault, and dismounted ground operations.

The management of low back pain accounts for a major part of the practice for military pain physicians. It is estimated that between 50% and 80% of the adult population will experience significant back pain at some time in their life. A significant proportion of these episodes are self-limiting, although recent studies have suggested that over one-third of these individuals may continue to experience pain for up to 12 months and longer from their first presentation, despite a return to their previous work status and function.⁷

Among those who seek medical advice, the majority will not receive a definitive diagnosis. This situation demonstrates that back pain is a symptom rather than a diagnosis. Even in those individuals who go on to receive further work-up and treatment, it is often dif-

ficult to correlate symptoms with pathology. For low back, mid-back, and neck pain, multiple studies have demonstrated a high rate of abnormal radiological findings in asymptomatic individuals.⁸⁻¹⁰ Military physicians should therefore focus less on identifying a precise cause, which is often not possible, and more on returning an individual to maximal functional capacity, which will reduce the impact on unit effectiveness.

Etiology of Back Pain

There is often a very poor correlation between the actual process of the disease, the signs and symptoms, and the investigations carried out. This is frustrating for both practitioner and patient; the latter may be overly focused on obtaining a precise diagnosis. Within the spine there are numerous structures that can give rise to back pain. For the pain physician, it is much more important to identify or rule out a small number of specific conditions that, if missed, might prove catastrophic than to try pinpointing one particular structure as the principal cause of chronic pain. The potentially catastrophic conditions make up only a small proportion of back pain cases; however, it is vitally important that they are recognized and treated quickly. Their signs and symptoms should be considered red flags (Table 23-2).

Nonspecific or Mechanical Back Pain

Nonspecific or mechanical back pain is more of a description than a diagnosis, and generally implies pain arising from the posterior elements of the spine. Mechanical back pain typically involves the lower lumbar region, but may also be referred into the groin or posterolateral thighs. It is usually confined to above the knee. Although many structures have been suspected of causing this type of pain, the muscles and ligaments are perhaps the most commonly implicated. Multiple studies have demonstrated increased electromyographic activity in low back pain sufferers irrespective

TABLE 23-2

WHAT NOT TO MISS: RED FLAGS SUGGESTING SERIOUS UNDERLYING PATHOLOGY OR NERVE ROOT PATHOLOGY

Red Flag	Possible Underlying Conditions	Individuals at Increased Risk	Associated Signs and Symptoms
Age > 50 years	Metastases, vertebral fractures, herpes zoster, or life-threatening conditions such as aortic rupture or perforated bowel	<i>Malignancy</i> : positive family or previous cancer history, positive smoking history, unremitting pain not relieved by recumbency <i>Zoster</i> : risk of acute infection and postherpetic neuralgia exponentially increase with age <i>Vertebral fracture</i> : h/o fall or other trauma <i>Abdominal pathology (aortic aneurysm)</i> : h/o smoking, hypertension, vasculitis, abdominal trauma, positive family history; prior surgery (ruptured bowel)	<i>Malignancy</i> : unexplained weight loss, unremitting pain not relieved by recumbency <i>Zoster</i> : history of rash <i>Abdominal pathology</i> : concomitant abdominal discomfort, peritoneal signs, nausea, and vomiting
Age < 20	Congenital anomalies (eg, spina bifida); early-onset disorders (eg, Scheuermann's disease); conditions associated with substance abuse (ie, osteomyelitis)	<i>Congenital disorders</i> : neurological symptoms, positive family history, other congenital abnormalities, systemic disease (eg, diabetes, epilepsy for spina bifida) <i>Substance abuse</i> : males, depression or other psychiatric condition, poor school or work performance	<i>Congenital anomalies</i> : birth marks, overlying skin tags, patches of hair
Trauma	Vertebral fractures, sacroiliac joint pain	<i>Vertebral factors</i> : old age, gait abnormalities, osteoporosis, female gender, previous fractures, corticosteroid use, Asian and Caucasian race	Fractures, ecchymoses, peritoneal signs
Systemic illness	Vertebral fractures, spinal infections, metastases	<i>Spinal infections</i> : recent infections, intravenous drug abuse, immunosuppression, recent spinal procedures, diabetes, older age	<i>Spinal infections</i> : malaise, fever, chills, tenderness, leukocytosis, local signs of infection, elevated ESR
Constitutional symptoms	Metastases, spinal infections	<i>Spinal metastases</i> : patient with breast, lung, prostate, or thyroid cancer	See <i>Spinal infections</i> , above. Signs of discitis may be subtle; signs of meningitis may be fulminant and include meningeal signs
Immunosuppression or steroid use	May predispose patients to infectious process, malignancy, or vertebral fractures	Patients with prolonged corticosteroid or immunosuppressive drug use (eg, transplant recipients, autoimmune disease). Most common locations for vertebral fractures are mid-thoracic, thoracolumbar junction, and lower lumbar regions	<i>Vertebral fracture</i> : focal tenderness, sudden onset, pain worsened by any movement and relieved by lying on back, height loss and deformity
Widespread neurological symptoms	Cauda equina syndrome, myelopathy, multiple sclerosis	Patients with large disc herniations, recent (< 48 hours) spinal procedures, traumatic injury, malignant or benign spinal tumors, spinal stenosis, and inflammatory conditions (eg, ankylosing spondylitis and Paget's disease)	Marked motor and sensory deficits involving multiple nerve roots, gait disturbances, overflow incontinence, saddle anesthesia, and diminished reflexes and sphincter tone
Unrelenting pain	Psychogenic pain/somatoform disorder, malingering, malignancy, life-threatening abdominal pathology	<i>Psychogenic pain</i> : h/o depression, anxiety, psychosocial stressors, multiple somatic complaints, drug or alcohol problems	<i>Psychogenic pain</i> : Signs of nonorganic pathology (ie, Waddell's signs), changes in appetite or sleep habits, difficulty concentrating and irritability, irrational fears, panic attacks

ESR: erythrocyte sedimentation rate; h/o: history of

Adapted from: Cohen SP, Argoff CE, Carragee EJ. Management of low back pain. *BMJ*. 2008; 337: a2718.

of the etiology, and clinical trials have demonstrated efficacy for muscle relaxants and botulinum toxin in back pain patients.¹¹⁻¹⁵ Additional evidence for the role of muscular pathology as a contributor to low back pain comes in from numerous studies demonstrating the effectiveness of neuromuscular reeducation and lumbar stabilization.¹⁶

Significantly, there are generally no signs of nerve root dysfunction in nonspecific back pain. When referred pain is present, it is usually in a non-dermatomal distribution. Despite the numerous tests that have been advocated for low back pain, no single feature in the history or physical examination can reliably identify a particular structure as the primary source of pain.¹⁷ Other causes of nonspecific back pain can include facet joint pain, myofascial pain, sacroiliac (SI) joint pain, and bony pathology (Table 23-3).

Facet (Zygapophyseal) Joint Pain

The facet joints are true synovial joints containing a joint space, cartilaginous surfaces, a synovial membrane, and a fibrous capsule. The capsule is richly innervated, such that any disruption is a potential source of pain. Similar to other synovial joints, the facet joints are vulnerable to the inflammatory and degenerative changes seen with both rheumatoid arthritis and osteoarthritis. The lumbar zygapophyseal joints typically bear between 3% and 25% of the axial load; this burden increases with disc degeneration and facet joint hypertrophy (Figure 23-2).¹⁸ Depending on the particular spinal level, lateral and forward flexion can significantly increase the stress on the joints (Table 23-4).¹⁹ In view of their large load carriage and the repetitive strain associated with military training, service members are at increased risk of developing facetogenic back pain.

Patients with facet-mediated pain typically present with localized pain and tenderness. One study found that paraspinal tenderness to be a strong predictor of successful lumbar facet radiofrequency denervation.²⁰ Symptoms typically worsen with lumbar motion and load carriage. The pain may radiate to the posterolateral thigh, especially when stress is applied to the facet joints. However, no symptom or provocative maneuver is pathognomonic. Most studies have demonstrated that imaging poorly correlates with symptoms. Plain films and computed tomography scans may show hypertrophic joints, erosion of endplates, and nonspecific acute and chronic inflammatory changes. There is a general consensus that fluoroscopically guided, low-volume facet joint or medial branch blocks are the most reliable means to identify a zygapophyseal joint as the pain generator. Whereas these injections are

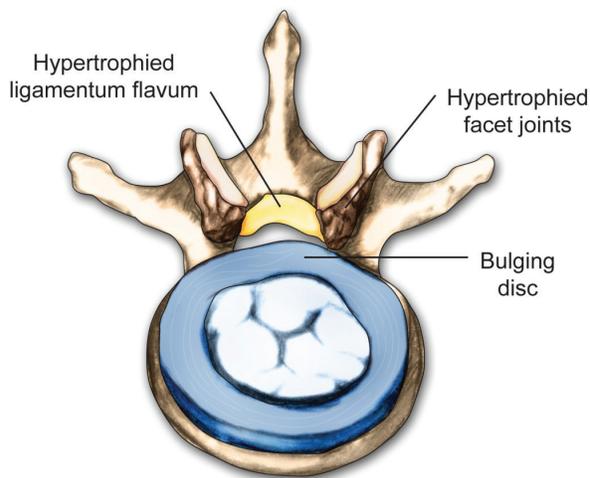


Figure 23-2. Axial view of a vertebral body demonstrating spinal stenosis secondary to hypertrophied facet joints and ligamentum flavum, and bulging discs. Reproduced with permission from: BMJ Publishing Group Limited [Cohen SP, Argoff CE, Carragee EJ. Management of low back pain. *BMJ*. 2008;337:a2718.]

associated with a high false-positive rate,^{21,22} a recent randomized comparative cost-effectiveness study that included active duty service members demonstrated that utilizing multiple blocks in an effort to reduce the false-positive rate will lower the overall success rate for treatment.²³ Controlled studies have shown that between 50% and 67% of carefully selected individuals will obtain intermediate-term relief from facet joint radiofrequency denervation.^{24,25}

Musculature of the Back and Myofascial Pain

The significance of the paraspinal musculature as primary pain generators has not been well elucidated. What is known is that the muscles contain a significant population of A- δ and C fibers (see explanation above), and represent by far the largest surface area in the lumbar region. A- δ and C fibers serve a nociceptive function, and may therefore play an etiological role under stressful conditions. On examination of some patients, it may be possible to identify areas of muscular spasm and occasionally discrete trigger points that respond to targeted injections. In some cases targeted injections may produce dramatic reduction in pain symptoms.

Sacroiliac Joint Pain

The mechanism of injury in SI joint pain is often described as a combination of axial loading and abrupt rotation. Unlike pain from internal disc disruption

TABLE 23-3
FEATURES DISTINGUISHING DIFFERENT CAUSES OF SPINE PAIN

Condition	History	Physical Examination	Diagnosis in Theater	Treatment in Theater
Myofascial pain	Focal neck or back pain, usually after inciting event	Nonfocal neurological exam. Spasm or swelling may be noted	History and physical examination	More than 80% of cases improve spontaneously. Ice and heat may be helpful. Resume activities as soon as tolerated. NSAIDs and muscle relaxants beneficial in short term
Radiculopathy from herniated disc	Usually unilateral pain extending to distal extremity, often in dermatomal distribution. Sensory and motor changes common	Straight leg raising and Spurling's test are sensitive but not specific. Sensory and motor deficits may be present. Reflexes may be impaired	History and physical exam more than two-thirds accurate. CT scan 90% sensitive in detecting disc pathology	Natural course is improvement and recurrence. Epidural steroids may hasten recovery. Weak treatment effect for adjuvants (eg, anticonvulsants and antidepressants). PT and exercise are beneficial
Facet joint arthropathy	Usually symmetrical pain extending to the proximal extremity, head, or groin	No reliable physical signs. Normal neurological exam. Paraspinal tenderness often present	Diagnosis made by local anesthetic blocks. High false-positive rate	Intraarticular injections are effective in only a small percent of patients with acute inflammation. Radio-frequency denervation may provide intermediate-term relief in carefully selected patients. PT and exercise are beneficial. Small effect size for NSAIDs and antidepressants
Discogenic pain from degenerative disc disease	Usually symmetrical pain radiating into proximal extremity, head, or groin. Lumbar pain aggravated by sitting	Pain worsened by forward flexion. Midline tenderness often present. Normal neurological exam	CT scan has poor specificity. Discography not indicated in theater	PT and exercise are beneficial. Small effect size for NSAIDs and antidepressants
Sacroiliac joint pain	Often unilateral pain that frequently occurs after trauma or surgery. Often extends into upper leg, groin, and occasionally lower leg	Tenderness overlying SI joint usually present. Single provocative tests unreliable. Normal neurological exam	Diagnosis made by LA blocks, which have high false-positive rate. Battery of provocative tests have moderate sensitivity and specificity	SI joint blocks may provide short-term relief. Radio-frequency denervation may result in intermediate-term relief in select patients with extraarticular pathology. PT and exercise are especially beneficial. Small effect size for NSAIDs and antidepressants

CT: computed tomography; LA: local anesthesia; NSAID: nonsteroidal antiinflammatory drug; PT: physical therapy; SI: sacroiliac

TABLE 23-4
MOTIONS ASSOCIATED WITH THE LARGEST INTERVERTEBRAL ANGULATION AND STRAIN FOR THE LUMBAR FACET JOINTS

Facet Joint Level	Movement Associated With Maximal Intervertebral Angle	Largest Strain
L1-2	Right bending	Right bending
L2-3	Left bending	Right bending
L3-4	Right bending	Right bending
L4-5	Forward flexion	Forward flexion
L5-S1	Extension	Forward flexion

Adapted with permission from: Ianuzzi A, Little JS, Chiu JB, Baitner A, Kawchuk G, Khalso PS. Human lumbar facet joint capsule strains: I. During physiological motions. *Spine J.* 2004;4:141-152.

(ie, discogenic pain) and facetogenic pain, which are typically insidious in onset, a specific inciting event can be identified in between 40% and 50% of cases of SI joint pain, most commonly motor vehicle accidents, falls, and repetitive strain from sports.²⁶⁻²⁸ In the military population, airborne-related parachute landings and repetitive stress from physical training render service members at increased risk for developing SI joint pain.

SI joint pain is a heterogeneous condition, and can be classified as either intraarticular or extraarticular. Not surprisingly, intraarticular pathology is more likely to occur symmetrically in the elderly, while younger individuals are more likely to present with unilateral extraarticular SI joint-mediated pain. SI joint pain is frequently associated with other musculoskeletal conditions such as trochanteric bursitis and facet joint pain.

Similar to zygapophyseal joint pain, no isolated symptom or physical exam sign can distinguish a painful SI joint from other potential pain generators, although some systematic reviews have found that utilizing a battery of provocative tests^{29,30} can accurately identify most cases. In a study by Slipman et al,³¹ the authors found that in 50% of patients with SI joint pain, the pain was referred into the lower extremity, and in 28% of cases it extended into the distal leg.

The reference standard for making a diagnosis of SI joint pain is via a low-volume injection, which is also associated with a high false-positive rate.³² Both intraarticular and extraarticular injections with corticosteroids may provide at least short-term relief to patients with SI joint pain^{33,34}; at least one study³⁵

determined that utilizing both approaches provides superior results. Radiograph guidance should always be used to perform SI joint procedures, because “blind” attempts miss the target in the large majority of cases.³⁶ In patients who obtain only temporary relief from corticosteroid injections, radiofrequency denervation has been shown in controlled studies to provide intermediate-term relief in a majority of individuals.³⁷ Because the lateral branches amenable to radiofrequency lesioning innervate extraarticular rather than intraarticular structures, young adults such as service members are especially likely to benefit from denervation.^{38,39}

Back Pain and Disc Lesions

In addition to radicular symptoms resulting from prolapse, intervertebral discs can be sources of pain through degeneration. This pain is often referred to as discogenic pain, in contrast to radicular pain, which is the result of nerve root irritation. Discs are attached superiorly and inferiorly to the intervertebral body endplates. Anteriorly and posteriorly, they are attached to the longitudinal ligaments. The discs themselves are made up of a central gelatinous mass, the nucleus pulposus, surrounded by fibrocartilaginous annulus fibrosus. The annulus fibrosus is comprised of 10 to 20 concentric layers of collagen fibers called “lamellae,” which pass obliquely between adjacent vertebral bodies and attach to the anterior and posterior ligaments.

As individuals age, there is inevitable loss of disc integrity. As the number of intact lamellae decreases as a result of repetitive strain or acute torsional events, the load borne remains the same, so that eventually the threshold for nociception is reached. Fractures in the endplates can also result in inflammatory cytokines leaking into the nucleus fibrosus. Degenerative discs contain more extensive and deeper nerve in-growth than normal discs. As annular tears develop, the cytokines may come into contact with nociceptors, resulting in chemical sensitization. Given the nature of military service, this process may be accelerated in service members.

The typical presentation of discogenic pain is axial pain, often referred into the lower extremity, which is exacerbated by sitting or forward flexion. In light of the high prevalence rate of degenerative disc disease in asymptomatic individuals, it can be extremely difficult to correlate symptoms with imaging results. Discography, although advocated as a means to identify painful intervertebral discs, is fraught with controversy regarding its prognostic value, high false-positive rate, and uncertainty about whether or not it injures discs.

Back Pain With Nerve Root Compromise

Back pain with nerve root compromise may occur from prolapsed intervertebral discs, degenerative bony lesions, and spinal stenosis. By far, herniated discs are the most common cause of neuropathic back pain in service members, with the peak incidence occurring during the 3rd and 4th decades of life. The two most frequently affected nerve roots are L5 and S1, reflecting the fact that the lowest lumbar disc is most likely to degenerate and herniate. In over one-third of cases, two or more nerve roots are involved. Younger individuals are also more likely than the elderly to note a specific inciting event.

Cauda equina syndrome, although rare, is critically important to identify. It is usually caused by a large, midline disc herniation that impinges upon the sacral nerve roots. This is the reason for the characteristic loss of bladder and bowel control, and absent or diminished perineal or saddle sensation. It may also be accompanied by sciatica, unilateral or bilateral depending on the type of disc herniation, and motor weakness or paralysis. Cauda equina syndrome represents a true surgical emergency and requires immediate referral and medical evacuation to an appropriate treatment facility.

If a normal nerve root is compressed, it may be accompanied by loss of function but is not normally painful. Some studies suggest that previous exposure to inflammatory cytokines is necessary for radicular pain.⁴⁰ However, with chronic compression the nerve root becomes inflamed and irritated, and pain can therefore occur. In addition to pain caused by chronic root compression, pain may also result from physical distortion of neighboring anatomical structures such as muscles, ligaments, and joint capsules.

When individual nerve roots are compressed, pain typically occurs in a dermatomal distribution, though there is significant dermatomal overlap and over a third of cases of radiculopathy involve multiple nerve roots. Because the amount of force necessary to herniate a disc varies inversely with the degree of disc degeneration, radicular pain usually involves the back as well as the distal parts of the lower limbs. Systematic

reviews have determined that the straight leg raising test is about 85% sensitive and 52% specific in detecting lower lumbosacral radiculopathy.⁴¹ For spinal stenosis, the test's sensitivity is less; for upper lumbar herniated discs, the femoral stretch test may be useful in distinguishing radicular pain from referred mechanical back pain. Whereas acute radiculopathy secondary to a herniated disc will usually resolve spontaneously as the disc retracts, patients often experience recurrences of symptoms.

In individuals with radiculopathy, epidural steroid injections may provide at least short-term benefit, and can be repeated in a series of shots when pain recurs. The transforaminal approach, which directly deposits the injectate over the affected nerve roots and into the ventral epidural space, may be more effective than a conventional interlaminar approach.⁴²

Spinal Stenosis

Spinal stenosis can occur in the central part of the spinal canal, the lateral recesses, or the intervertebral foramen. There are many possible causes of spinal stenosis, including disc protrusions, ligamentous hypertrophy, facet joint arthritis, spondylolisthesis, and congenitally short pedicles. Because most of these processes involve chronic degenerative changes, spinal stenosis is much more common in the elderly, and tends to be more chronic and progressive than radicular pain secondary to a herniated disc.

Central stenosis commonly presents as pain in the lower back extending into the lower legs. Extension of the spine can exacerbate the discomfort, while flexion may ease the symptoms. A common observation is that patients find it easier walking uphill or upstairs than down. Lateral recess and foraminal stenosis tend to include pain and discomfort in a radicular distribution, and may or may not be associated with sensory changes or motor dysfunction. Although epidural steroid injections can provide significant relief to patients with spinal stenosis, the duration of benefit tends to be shorter than in individuals whose pain is from a herniated disc.

NECK PAIN

Approximately two-thirds of individuals will experience neck pain throughout their lives. The annual prevalence rate is about 40%, and it occurs somewhat more frequently in females.^{43,44} As with back pain, cervical spine pain is often multifactorial in nature, and may be due to problems with bony structures such as the facet joints, intervertebral discs, soft-tissue pathology, and nerve root or spinal cord compression. Post-

traumatic neck pain is common, particularly following motor vehicle accidents. As with back pain, neck pain may be the presenting feature of serious underlying systemic disease, which should be excluded by history, examination, and imaging.

Many predisposing factors render military personnel at increased risk for neck pain, and many of them are similar to the factors predisposing individuals to

back pain. Common inciting factors include heavy load carrying (including the burden of combat body armor), abnormal postures, work-related stress, transport in military vehicles with hard suspensions over unpaved roads, and many others.

Cervical Radiculopathy

Cervical radiculopathy results from compression of nerve roots due to degenerative disease or disc protrusion. Symptoms may include neck and arm pain, most commonly unilateral; sensory loss; weakness; and possibly diminished reflexes. Disc prolapse is most common at C5–6 and C6–7. Young, physically active individuals such as military personnel are more likely to suffer an acute onset of symptoms (most likely disc prolapse), whereas in the civilian population the onset is more likely to be gradual. The treatment of cervical radiculopathy is similar to that for lumbar radiculopathy, except that the transforaminal approach to epidural steroid delivery is rarely used due to the higher risk of paraplegia and death with particulate steroids.⁴⁵

Cervical Myelopathy

Similar to radiculopathy, spondylotic myelopathy may occur as a result of disc herniation or bony overgrowth. Cervical spondylotic myelopathy is the most common cause of spinal cord dysfunction in older persons. The aging process results in degenerative changes in the cervical spine, which in advanced stages can cause compression of the spinal cord. Symptoms often develop insidiously and are characterized by neck stiffness; arm pain; numbness, tingling, and weakness in the hands; and clonus. In addition, other features such as bladder dysfunction and gait disturbances may be observed. On physical exam, clonus, hyperreflexia, and other signs of upper motor neuron lesions such as Hoffmann's and Babinski's signs may be present. The differential diagnosis includes other conditions that can result in myelopathy such as multiple sclerosis, amyotrophic lateral sclerosis, and tumors that impinge on the spinal cord. The diagnosis is confirmed by a magnetic resonance imagery scan. Myelopathy is generally progressive in nature, and will not generally resolve spontaneously. Patients with ongoing and progressive disease should be referred for urgent decompressive surgery.

Occipital Neuralgia

Occipital neuralgia is a frequent cause of occipital headaches. It usually describes recurrent pain in the

upper neck and occipital region, within the distribution of the greater and lesser occipital nerves. These nerves are derived from the posteriors C2 and C3 nerve roots.

Occipital neuralgia is unilateral in 85% of patients, with the greater occipital nerve being involved more frequently (90%) than the lesser occipital nerve (10%). In approximately 10% of cases both branches are involved.⁴⁶ Patients with occipital neuralgia typically describe a unilateral pain characterized by piercing, throbbing, or "electric-shock-like" sensations in the upper neck, back of the head, and behind the ears. Often, the pain begins in the neck and spreads upward. Some individuals experience pain in the scalp, forehead, and behind the eyes. There is usually tenderness overlying the trunk or course of the nerve, which can elicit pain in the nerve distribution. The cause of occipital neuralgia may be irritation or injury to the nerves as a result of overly tight neck or scalp muscles causing compression of the nerve. Some studies suggest trauma to be a common precedent.⁴⁷ In one epidemiological study evaluating service members evacuated from Operations Iraqi and Enduring Freedom for headache, 5% had a primary diagnosis of occipital neuralgia, with 46% of these individuals citing physical trauma as the precipitating event.⁴⁸ Frequent lengthy periods of keeping the head in a forward flexed position may contribute to occipital neuralgia; however, in most cases no specific cause can be found. The diagnosis of occipital neuralgia is confirmed by nerve block, which in some cases can provide long-standing benefit when corticosteroids are added. In those individuals who fail to obtain sustained benefit, pulsed radiofrequency may provide long-term relief.^{49,50}

Whiplash Injuries of the Neck

The most common cause of chronic neck pain is whiplash injury. Whiplash is commonly associated with acceleration–deceleration injuries, which force the neck into hyperextension and flexion, then rebound. A common scenario is a motor vehicle accident where an affected individual undergoes a rear-end impact. One of the earliest studies on whiplash was performed by Severy et al,⁵¹ who demonstrated the importance of phasing differences during acceleration and deceleration between the vehicle and human volunteers subjected to rear-end collisions. The peak acceleration of the vehicle preceded that of the torso, which in turn preceded that of the neck and head. This established that a critical element of whiplash involved inertial loading of the neck, as the torso abruptly moved forward under an initially stationary

head.⁵¹ A review by Bogduk and Yoganandan⁵² concluded that in whiplash injuries, instead of the facet joint articular processes gliding across one another, the inferior articular processes of the moving vertebrae chisel into the superior articular processes, resulting in microscopic injury.

The role of the cervical zygapophyseal joints is supported by prevalence studies suggesting that the prevalence of facetogenic pain in individuals with chronic neck pain after whiplash injuries is around 50%.^{53,54} If the head is not in the neutral anatomical position during impact, injuries can also occur in the rotational and/or lateral flexion planes. Other structures that may contribute to neck pain after trauma include muscles, ligaments, discs, and the atlanto-axial and atlanto-occipital joints. In one cadaveric study involving rear-end impacts without head rests, injuries to the cervical intervertebral discs were found

in 90% of cases, tears of the anterior longitudinal ligament in 80%, tears in the cervical zygapophyseal joint capsules in 40%, and vertebral body fractures in 30%. In the cadavers protected by head rests, no injuries were found.⁵⁵

Early symptoms after whiplash injuries include neck and shoulder stiffness, and occipital pain. There may be localized tenderness on palpation, and reduced range of movement in the cervical spine. Many people complain of headaches. Neurological symptoms are rare and if present may indicate more extensive damage. Imaging is likely to be of little use in the vast majority of cases; with the natural course most people will recover with conservative measures such as nonsteroidal antiinflammatory drugs and physiotherapy. About 10% of individuals develop persistent symptoms. In some of these cases, emotional and psychological distress can be disproportionate to pathology.

TREATMENT OPTIONS FOR BACK AND NECK PAIN

Medical officers in the field do not have the full range of treatment modalities available to the civilian practitioner; however, a number of therapeutic options are available (Tables 23-5 and 23-6). Similar to civilian practice and treatment in garrison, treatment options in theaters of operation will ideally utilize a multimodal approach, albeit with certain considerations. Military pain specialists are primarily deployed as anesthesiologists or psychiatrists, so pain management is a secondary mission. Thus at any given time, experienced physicians may or may not be available to provide the full range of interventional techniques described below. The end result is that patients may be seen and treated only if sufficient expertise, time, space, and equipment are available. Future leaders in military medicine should strongly consider recognizing pain medicine as a separate subspecialty so that the availability of interventional pain treatment services is not contingent on the presence of anesthesiologists, psychiatrists, or neurologists who may or may not have received adequate specialty training. In the interim, primary care physicians should be capable of triaging pain patients to prioritize treatment for those with a reasonable likelihood of remaining in theater with proper therapy, so as not to unnecessarily overburden already strained resources.

When considering analgesic medications, the same classes of medications used in civilian practice are available to the medical officer, although the choices within those classes may be limited. Simple analgesics such as paracetamol (acetaminophen), along with non-steroidal antiinflammatories, form the foundation of

analgesic treatments. As pain requirements increase, the medical officer may consider the use of opioids, starting with weaker preparations such as tramadol or codeine, and progressing to stronger drugs such as morphine. Most pain physicians believe that opioids are a reasonable treatment for some patients with acute

**TABLE 23-5
PAIN TREATMENTS COMMONLY AVAILABLE TO MEDICAL OFFICERS***

Treatment	Examples
Physical therapies	Graded exercise, iontophoresis
Complementary and alternative therapies	Acupuncture, spinal manipulation
Neuromodulation	TENS, spinal cord stimulation†
Injection therapy	Epidural steroid injections, facet joint injections, radiofrequency lesioning, regional anesthesia
Pharmacological interventions	Analgesia based on WHO analgesic ladder
Psychological interventions	Cognitive-behavioral therapy

*Availability depends on the facility at which an individual is treated. Injection therapies are not suited to truly austere combat areas and should be carried out only in appropriate clinical settings.

†Available in garrison only.
TENS: transcutaneous electrical nerve stimulation
WHO: World Health Organization

TABLE 23-6

INTERVENTIONAL PROCEDURES FOR PAIN AVAILABLE IN THEATER IN SUITABLE ENVIRONMENTS

Technique	Injectate Volume*	Fluoroscopy	Comment
Cervical ESI	2–4 mL	Yes	Risk of permanent injury or death, especially with transforaminal approach. Use of local anesthetic controversial
Interlaminar lumbar ESI	3–5 mL	Strongly advised	Fluoroscopy associated with increased likelihood of injectate in target area
TFESI	2–3 mL	Yes	Superior outcome compared to the interlaminar approach
Facet joint injection	Cervical 1 Lumbar 1-2	Yes	Good outcome only in carefully selected patients with acute symptoms
Facet joint RF denervation	0.5–1 mL before lesioning	Yes	Moderate evidence for relief lasting > 6 months
Greater and lesser occipital nerve blocks	2–4 mL	No	Can be difficult to distinguish from referred cervical pain
SI joint injection	2–4 mL	Yes	Greater likelihood of placing injectate in target area with fluoroscopy
SI joint RF denervation	0.5–1 mL before lesioning	Yes	Targeted levels include L5–S3 and sometimes L4 and S4. More effective for extraarticular pathology
Piriformis injection	2–8 mL	Yes	Presentation may be similar to radicular pain, although straight leg raising test is likely to be negative. Injection of local anesthetic may lead to sciatic nerve weakness

*Injectate volume is the total volume and usually comprises a mixture of long-acting (depot) corticosteroid and local anesthetic.

ESI: epidural steroid injection; RF: radiofrequency; SI: sacroiliac; TFESI: transforaminal ESI

spinal pain episodes. However, long-term use should be balanced against the proven adverse effects of these drugs, such as impaired cognition and reduced reaction time, attention, balance, and memory, especially in the period following initiation of treatment. Individuals on long-term opioids require close clinical supervision, as do those individuals who fit into the demographic and clinical profile of young, combat-hardened service personnel, who may be suffering from comorbid physical and psychological illnesses that predispose them to an increased risk of misuse and diversion. Studies suggest that younger individuals such as service members may develop tolerance at faster rates than the elderly.⁵⁶

Other drug treatments include the use of tricyclic antidepressants and anticonvulsants such as gabapentin and pregabalin. In very carefully selected patients with clear-cut neuropathic pain, the number needed-to-treat for one patient to obtain clinically meaningful benefit with first-line agents (eg, nortriptyline, gabapentin) tends to range between 2.5 and 4. For spinal pain, the likelihood of success is generally acknowledged to be significantly lower. Currently, only duloxetine, a serotonin-norepinephrine reuptake inhibitor, is the only drug approved for spinal pain. Large metaanalyses have failed to produce strong evidence in favor of one particular group of drugs over another.

SUMMARY

As the nature of combat evolves, the prevention and treatment of NBIs comprise an increasingly important role for medical officers. Although most of these conditions are similar to those encountered in civilian practice, the considerations and implications differ. Differences between treatment

in theater and in garrison include limited resources in the former, the subordination of pain medicine to more emergent endeavors (ie, stabilization of combat-wounded personnel), prioritizing treatment outcomes (ie, RTD) over diagnostic specificity, and the need for the rapid realization of treatment

results, which often results in multiple concurrent interventions. In order to optimize treatment outcomes, medial officers in forward-deployed areas should be able to distinguish between patients who may benefit from pain medicine specialty referral, and those who can be effectively treated with conservative measures not requiring evacuation to a level-3 treatment center.

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