Low back pain (LBP) is the second most common medical condition in the United States, affecting millions of people every year and costing billions of dollars between health care expenditures and lost workdays. The overall occurrence of LBP ranges from 13.8% to 31%, and within this population, the incidence of a radicular component to the pain is estimated at 12% to 40%. In industrialized nations, the lifetime prevalence of LBP can be as much as 70%. Moreover, at some point in life, 84% of people experience some form of LBP.

Clinical Presentation

Although LBP is defined as discomfort located in the region below the posterior ribs and above the lower margin of the gluteal muscles, it has various causes and etiologies. To effectively treat the pain, one must delineate the source and target the therapy. Appropriate diagnoses and treatments can mean the difference between a self-limiting muscle strain secondary to overuse and major, costly surgical intervention for a severe lumbar radicular syndrome. The delineation of the source and the appropriate therapy occurs primarily as a...
Fever can be present during infectious causes of LBP. For result of the practitioner conducting a thorough history and physical examination. Radiography and laboratory data also provide key information in defining causation.

Determining the onset of pain will separate acute episodic pain from chronic systemic disorders. It is important to rule out a history of trauma. The location of the pain should be pinpointed. The practitioner should also ascertain whether the painful sensation contains a radicular component. Neural impingement is typically associated with pain, numbness, and paresthesia radiating to the lower extremity.

Aggravators and alleviating factors, such as pain aggravated by motion and improved by immobility, help describe the mechanical quality.

Time of day is important in diagnosing LBP. For instance, inflammatory causes of pain typically occur in the morning, whereas pain caused by overuse of muscle typically occurs at the end of the day.

The quality of the pain can separate musculoskeletal pain, which is described mostly as aching in nature, from the pain caused by neural injury (typically described as burning).

Although important, the intensity of the pain does not assist in arriving at a diagnosis; however, it must be documented to follow the efficacy of the treatment modalities used.

Other important historical concerns that can point toward the correct diagnosis lie in systemic information:

- Fever can be present during infectious causes of LBP. For example, fever along with recurrent pain is most common with osteomyelitis.
• Weight loss in conjunction with pain in the supine position can suggest malignancy.
• Localized tenderness along the spine is more consistent with fractures.
• Pain associated with stiffness, particularly in the morning, is common in spondyloarthropathies.
• True radicular pain extends beyond the knee. Radicular pain associated with stiffness, particularly in the morning, is common in spondyloarthropathies.
• Intervertebral disc herniation occurs in 4%. Osteoporotic facet joints. These changes are most commonly age-related.

Differential Diagnosis

Physical Examination

Pertinent findings on physical examination that help in the diagnosis of LBP include inspection of the back to rule out kyphotic or scoliotic changes. Other tests include an examination of the patient’s range of motion. Palpation of the spine is useful to exclude fractures. Palpation of paraspinal muscles can identify foci of myofascial pain syndrome, or “trigger points.” The straight leg-raising (SLR) test helps in recognizing radiculopathy. Positive ipsilateral SLR test is sensitive to diagnose disc herniation but is not specific. However, a positive contralateral SLR test is almost 90% specific for disc herniation, although not very sensitive. In cases of radicular LBP, neurological examination is of special significance. Not only does it rule out CES but it also identifies nerve roots affected by the herniated disc. Decreased pinprick and temperature sensation with or without elements of motor loss can be present in these cases. Particular attention should be paid to L5 and S1, because more than 90% of all herniations occur at these levels.

Differential Diagnosis

The most common causes of LBP—more than 97%—are primarily mechanical and not attributable to infectious or malignant etiologies. Of these, 70% are caused simply by strain or sprain of back muscles. Ten percent result from degenerative changes, which typically affect the discs or facet joints. These changes are most commonly age-related. Intervertebral disc herniation occurs in 4%. Osteoporotic compression fractures account for another 4% of mechanical LBP, followed by spinal stenosis, which accounts for 3%. Less common causes of mechanical LBP include spondylolisthesis (2%), traumatic injury (<1%), and congenital abnormalities (<1%). Intradiscal disturbances (discogenic pain) are another source of this particular type of pain. Less common causes of mechanical LBP include spondylosis or other causes of vertebral instability. 

Approximately 1% of LBP cases are caused by nonmechanical etiologies. Malignancies such as multiple myeloma, metastatic lesions, or spinal cord tumors cause 0.7% of LBP cases. Of these nonmechanical etiology cases, 0.03% are inflammatory by nature, such as ankylosing spondilitis or Reiter syndrome. Infectious etiologies account for the least common causes of LBP (0.01%) and include osteomyelitis, epidural abscesses, or septic discitis, among others.

Disorders in the viscera, which project as pain to the low back, account for 2% of all cases of LBP. Thus, pathology of the pelvic or retroperitoneal organs must be ruled out when approaching patients who report LBP. Other rare causes that should be excluded include abdominal aortic aneurysms, pancreatitis, and gastroesophageal reflux disease. Thorough historical information tends to lead one toward delineating these visceral abnormalities.

Laboratory Studies

Most cases of LBP are uncomplicated, self-limiting, and resolve spontaneously. This is true particularly in LBP lasting less than 1 month. In only a few scenarios is diagnostic testing required. It is imperative to use diagnostic testing (either laboratory studies or radiological images) only after historical data and physical findings lead one to a path to rule in or rule out a particular syndrome.

In patients where systemic disorders are suspected, white blood cell counts, erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) level are helpful when infectious causes are suspected. In patients with osteomyelitis, the sensitivity for these test are 35% to 61%, 76% to 95%, and 82% to 98%, respectively. ESR and CRP level are useful in particular for spondyloarthropathies, each having positive predictive values of 100% and 95%, respectively. When occult malignancies are suspected, an elevated ESR (>20 mm/h) has a sensitivity of 78% and a specificity of 67% in detection.

Urinalysis (UA) is not a particularly useful test in patients with a history of LBP. However, there are rare instances in which a UA can be helpful should LBP be secondary to pyelonephritis.

Radiologic Testing

One large problem that contributes to the escalating cost of health care is the use of unnecessary radiologic testing. On study showed that in 2005, approximately 25% of imaging studies for patients with acute LBP were not medically indicated. These tests incurred unnecessary expenses and
exposed patients to large amounts of radiation. Abnormal plain radiographs, computed tomographic (CT) scans, and magnetic resonance imaging (MRI) scans are commonly ordered in many patients without symptoms of LBP. According to a study by Biering-Sørensen et al, 23% of asymptomatic patients had age-related changes that were noticeable on radiographs. Another study that specifically analyzed facet arthropathy in people between the ages of 40 and 80 years demonstrated arthritic changes within the facet in 60% of men and 67% of women. Even spondylolisthesis (Figure 1) is commonly seen in both symptomatic and asymptomatic patients.

MRI changes, particularly disc herniations, have been found in 20% to 40% of asymptomatic patients. Furthermore, spinal stenosis was present in up to 21% of patients older than 60 years. Diagnostically relevant MRI changes were reported in the LAIDBack Study, which included moderate to severe central stenosis, nerve root compression, and disc extrusion. Moreover, according to the study, other findings such as desiccation of discs, disc bulging, protruding discs, and loss of disc height were all commonly seen in patients with or without LBP.

Radiographic studies should correlate with the clinical picture and should not be ordered solely for diagnosis. According to the American College of Radiology (ACR), specific situations warrant specific images. For example, the ACR notes that the only indication for urgent MRI is radicular pain accompanied by urinary retention or progressive loss of motor function. Nonemergent MRI scans are indicated when radicular symptoms persist for more than 4 to 6 weeks or in the presence of pain associated with walking and secondary to possible spinal stenosis (neurogenic claudication).

LBP without radicular symptoms should be managed conservatively for 4 to 6 weeks before considering imaging. However, the exception to this rule is seen when the clinical picture indicates a systemic disease as the cause for pain (ie, fever, weight loss, hematuria). At that point, either a CT scan or an MRI scan is indicated. Overall, the majority of the self-limiting symptoms of LBP can be managed without the use of radiography.

Plain radiographs are useful, particularly when there is suspicion of fractures. Anteroposterior and lateral images are most useful. In patients with spondylolisthesis, flexion-extension view can provide helpful information.

Sometimes hip and pelvic radiographs are indicated in older patients when arthritis is suspected. If an MRI is warranted, scans without contrast are preferable for most patients with LBP requiring advanced imaging. These scans provide appropriate visualization of normal versus pathological discs, nerve roots, ligaments, epidural fat, and size and shape of the spinal canal.

In patients with a history of back surgery, intravenous gadolinium helps detect scarring. It is important to note that gadolinium is contraindicated in patients with renal impairment. CT scanning is better than MRI at revealing abnormalities in bone. CT scans are particularly useful in the diagnosis of sacroiliac joint (SIJ) disease, spondylolisthesis, and facet joint arthropathy, among others.

Intravenous contrast is useful in outlining epidural abscesses, although better results are obtained from MRI. Nonetheless, although MRI is considered to be the optimal test for most spine pathology, one study found that CT scanning, MRI,
Pain is related to a discrete, irritable point in skeletal muscle or fascia, not caused by acute local trauma, inflammation, degeneration, neoplasm, or infection. Myofascial pain usually presents with trigger points. The pain radiates in a distribution typical of the specific muscle harboring the trigger point.

Myofascial pain can arise in the superficial, intermediate, or deep muscles such as the sacrospinals, multifidus, quadratus lumborum, iliopsoas.

Myelograms are used primarily when multiple discs are abnormal, or multilevel radiculopathies are present, in patients with history of back surgeries with suspected disc herniation, or when the clinical situation precludes an MRI. Myelography involves injecting a nonionic water-soluble contrast material (such as iohexol) into the spinal canal and then following with plain radiography or CT. Given the invasive nature, there are increased risks associated with this procedure, similar to the risks associated with lumbar puncture. These tests are not routinely ordered and are usually conducted under the consultation of a spine specialist.

Electromyography (EMG) produces highly variable findings in assessing radicular pain, particularly in patients who lack motor deficit despite radicular symptoms. EMG is a useful modality in patients with radicular pain associated with myelopathy but with symptoms that do not correlate with radiographic studies. One study found EMG to be highly sensitive at diagnosing lumbar disc herniation that was surgically proven but not visible on imaging.

Discography is performed when contrast material is injected directly into the disc under fluoroscopic guidance. The contrast is placed into the nucleus pulposis. The study is considered positive when the contrast extravasates through tears in the disc. However, this process must also reproduce the symptoms the patient typically experiences. Benefits are highly controversial, as several recent studies have not found discography reliable in appropriately identifying patients with true intradiscal lesions. Furthermore, given its risks, which include possibly worsening pain symptoms, discography is not recommended by the American Pain Society for the diagnosis of LBP.

Interventional Treatments for Common LBP

Several interventional treatment options are available for the treatment of LBP.

Treatments for Myofascial Pain

Myofascial pain usually presents with trigger points. The term trigger point was coined in 1942 by Travell to describe a clinical finding with the following characteristics:

- Pain is related to a discrete, irritable point in skeletal muscle or fascia, not caused by acute local trauma, inflammation, degeneration, neoplasm, or infection.
- The painful point can be felt as a tumor or band in the muscle, and a twitch response can be elicited on stimulation of the trigger point.
- Palpation of the trigger point reproduces the patient’s pain, and the pain radiates in a distribution typical of the specific muscle harboring the trigger point.
- The pain cannot be explained by findings on neurological examination.

The trigger point model states that unexplained pain frequently radiates from these points of local tenderness to broader areas, sometimes distant from the trigger point itself. Practitioners claim to have identified reliable referred pain patterns, allowing practitioners to associate pain in one location with trigger points elsewhere. Many chiropractors and massage therapists find the model useful in practice, but the medical community at large has not embraced trigger point therapy. There is no consistent methodology for diagnosing trigger points, and there is a dearth of theory explaining how trigger points arise and why they produce specific referred pain patterns. Another criticism of the trigger point concept is that practitioners do not necessarily agree on what constitutes a trigger point.

Trigger points are defined as taut bands of muscle that are ropyl and tender to touch. Patients usually present with many trigger points. The prevalence of myofascial pain can be up to 20% in patients with chronic LBP. Muscular pain can originate in superficial, intermediate, or deep muscles such as the sacrospinals, multifidus, quadratus lumborum, or iliopsoas.

Triggers in these muscles can be injected with a local anesthetic-corticosteroid mix or botulinum toxin. Botulinum toxin has been shown to be quite effective in the treatment of axial back pain if muscle is thought to play a major role. Double-blinded studies have shown botulinum toxin injections to decrease pain scores up to 50% in 73% of the study group. EMG and fluoroscopic guidance can be used for trigger point injections, but in general, localization of points in the superficial and intermediate muscles do not require either.

Treatments for Discogenic/Radicular Pain

It is thought that discogenic or radicular pain originates secondary to inflammation, especially at the nerve roots. Inflammation may be secondary to disc herniation. A herniated disc can lead to leakage of the nucleus pulposus, which contains proinflammatory substances such as phospholipase A2, metalloproteases, nitric oxide, hydrogen ions, and stromelysin.

An epidural steroid injection (ESI) involves simply placing high concentrations of corticosteroids either in the epidural space (intralaminar approach) or around the affected nerve roots (ie, transforaminal approach). With an intralaminar approach, many structures may be exposed to injected medication, such as dorsal disc margin, dura, nerve roots, ganglia, spinal segmental nerve, pars interarticularis, laminae, and the anteromedial margins of the facet joints.

ESI is one of the most commonly used interventions in pain management for both acute and chronic presentations of radicular pain. It is thought that injecting corticosteroids...
directly to the nerve roots via the transforaminal technique may increase pain resolution and may even lessen the need for surgical intervention in some patients. For either ESI method, fluoroscopy is more commonly used at present and is the standard at most institutions. These injections are usually repeated, especially if there is partial improvement in patients’ symptoms. However, patients who obtain great short-term relief present as a dilemma, as repeated exposure to corticosteroids can induce hypothalamic-pituitary suppression.

In patients with chronic discogenic lower back pain unresponsive to conservative therapy, annuloplasty, also known as intradiscal electrothermal therapy (IDET), can be used. With degeneration of intervertebral discs, the annulus fibrosis develops tears that lead to chemical and mechanical activation of nociceptors. IDET was developed in the past decade to provide an alternative to surgical fusion in patients with chronic discogenic pain. The IDET ideally modifies collagen, decreases revascularization, and destroys nociceptive pain transmission. Few studies have shown dramatic improvement in pain scores after performing this minimally invasive procedure. The procedure involves using fluoroscopic guidance to place a large-bore needle into the affected disc. Thereafter, a flexible catheter with a heating tip is threaded circumferentially into the disc through the nucleus pulposus. Once the placement is confirmed, the catheter is heated to 90°C for 3 minutes. The procedure provides varying results with moderate evidence for managing lower back pain.

### Treatments for Sacroiliac and Facet Joint Pain

Nonbacterial sacroiliitis can be associated with ankylosing spondylitis, gout, rheumatoid arthritis, psoriasis, trauma, malignancy, and irritable bowel syndrome. SIJ pain is accepted as a source of LBP. However, it may be associated more with radiating pain to the groin, medial buttock, and posterior thigh. Diagnosing SIJ disease as a cause of LBP may be difficult by history, physical examination, and imaging studies. Injecting the joint under fluoroscopic guidance with local anesthetic can be both diagnostic and therapeutic. Cortisone can also be injected with the local anesthetic to provide anti-inflammatory and long-term benefits. Thermal or pulsed radiofrequency (RF) lesioning of the SIJ can be performed for long-term pain relief with varying results.

The facet joints are also known as the zygapophyseal joints (Figure 2). They are formed by the articulation of the inferior articular process of one vertebra and the superior articular process of the vertebra situated below. These joint are typically synovial joints, and the lumbar zygapophyseal joints are innervated by the medial branches of the dorsal L1-L5 rami of spinal nerves. Because 15% to 50% of axial LBP is attributable to degeneration or inflammation of these joints, a denervation technique is generally used.

The only definitive treatment for this joint pain is RF neurotomy, or ablation. RF usually follows a diagnostic medial branch block with local anesthetics. The false-positive rate of a medial branch block may be as high as 38%. The general recommendation is to use a short- and long-acting local anesthetic on two separate occasions, which provides relief in 80% of cases.

Aside from a diagnostic medial branch block, the zygapophyseal joint itself can be injected with local anesthetic and corticosteroids. This intra-articular injection may not be of any diagnostic value; however, it may be therapeutic and may offer the patient adequate relief to participate in physical therapy. Percutaneous RF neurotomy can be performed if the patient responds to the diagnostic medial branch blocks. The average duration of pain relief after RF is approximately 10 months and is successful in more than 85% of cases. RF ablation can be repeated with effective long-term pain management.

### Treatments for Vertebral Compression Fracture Pain

Vertebral compression fractures secondary to osteoporosis or metastasis are a common problem in the United States. Vertebroplasty has been used since the mid-1990s for the treatment of back pain. To consider vertebroplasty, the back pain should be from one of the following 3 causes: painful or collapsing vertebrae from hemangioma, spinal metastases, or osteoporotic bone loss. The procedure involves using fluoroscopic guidance of large-bore needles into the anterior third of the affected vertebral body. Once the adequate placement is confirmed, cement based on polymethylmethacrylate solution is injected. The cement is allowed to harden, and the pain relief can be instantaneous. It is unknown how many levels should be treated at any given time; however, no more than 3 are usually instrumented at one time.

Balloon kyphoplasty is very similar to vertebroplasty, except that vertebroplasty does not address the vertebral...
deformity that occurs. The indications are the same as those for vertebroplasty. The technique differs slightly, in that before cement injection, a balloon is inflated to expand the vertebral height and compress the osteoporotic bone. Success rates for both vertebroplasty and kyphoplasty at relieving pain are anywhere from 75% to 90%.\textsuperscript{28} Kyphoplasty results in significant pain relief, height restoration, and improved physical function that can be long lasting.\textsuperscript{29}

**Neuromodulation**

Spinal cord stimulation (SCS) is a more advanced procedure offered to patients who have failed or no longer respond to the above-mentioned procedures (Figure 3). The theory behind SCS dates back to the 1960s. It is well known that peripheral nociceptive signals are transmitted to the spinal cord in small-diameter, unmyelinated C fibers and lightly myelinated A delta fibers. Touch and vibration on the other hand are transmitted through large myelinated A beta fibers. Thus, large-fiber stimulation in the dorsal column should turn off small pain fiber signals.\textsuperscript{29}

A trial of stimulation is done before permanent placement in all patients and involves using fluoroscopic guidance to access the epidural space. Thereafter, electrode leads are threaded to the desired location. A trial period usually lasts about a week and, if successful, allows permanent implantation of a stimulator. Many retrospective studies indicate a range of 40% to 60% of good to excellent results in patients with implanted spinal cord stimulators.\textsuperscript{30} Patient selection may be of utmost importance with this treatment modality. In addition, psychological evaluation should be considered before each patient starts the trial.

**Acupuncture**

Clinicians are left with a dilemma regarding the value of acupuncture for the common pain condition of LBP. Acupuncture appears superior to no additional treatment; to usual medical care; and, for back pain, to optimal conventional care. However, acupuncture is not superior to other complementary treatments for back pain and confers no additional benefits for persons with osteoarthritis receiving advice and exercise.\textsuperscript{31}

Interestingly, both acupuncture and placebo analgesics are at least partially mediated by endogenous opioid release.\textsuperscript{32} Given the uncertainty raised regarding the value of acupuncture compared with placebo therapy, a pragmatic approach may prove most useful for patients with LBP. For LBP, there are few proven monotherapies, such as acupuncture, that feature a favorable safety profile and modest (most often for chronic back pain, osteoarthritis) to moderate (most often for failed back syndrome) benefit.

A reasonable view of the current evidence would add acupuncture to the therapeutic armamentarium as an option but not as the clear therapy of choice for any of these conditions. Acupuncture may be especially valuable for patients who prefer it to other options or are concerned about addition of analgesic medications or needling. Acupuncture might also be useful as part of a multitherapy package of care for some patients with chronic LBP.

**Conclusion**

Although the prevalence of LBP remains high worldwide, understanding the mechanisms and incipient conditions that lead to the development of this chronic pain syndrome seems accessible to any care provider. Knowledge of anatomy and understanding of basic concepts related to clinical symptoms and differential diagnosis help the health care practitioner identify early conditions that might otherwise escalate to increasing pain. Delayed diagnosis puts the patient at risk for “late-in-the-process” surgical interventions, decreasing quality of life and increasing the amount of time spent with health care providers. Ultimately, all of these interventions lead to a high level of health care financial burden to our society.

**Acknowledgment**

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References
Multisymptom Pain Disorders Plague Returning Service Men and Women

According to a news release issued by the American Pain Society (APS), nine in 10 Iraq and Afghanistan war veterans return to the United States with some form of pain, and approximately 60% have significant pain, mainly from the cumulative effect of exposure to recurring blasts that cause unimaginable injuries, according to prominent Department of Veterans Affairs (VA) pain clinicians who spoke at the APS annual scientific meeting held in May in Baltimore, Maryland.

“We are talking about a complicated set of problems involving cognitive issues, deep emotional impacts, and acute and chronic pain, that have serious, long-term implications for our veterans and make effective pain treatment outcomes far more difficult to achieve,” said Michael E. Clark, PhD, clinical director of the VA’s largest and most comprehensive pain management and rehabilitation program in Tampa, Florida. Clarke also is associate professor of psychology at the University of South Florida.

“The pain constellation exhibited by returning service members is the most complex situation I have ever seen in my 30 years of practice and calls for a revolutionary new approach to simultaneously address the spectrum of shared, common symptoms across these severe disorders,” Clark said.

“These Middle East conflicts, with their very high level of blast injury survivors, call for the military, the VA and the civilian health system to treat post-injury pain as a priority after military discharge to prevent pathophysiology, with a focus of providing effective pain control and rapid restoration of function and social networks to prevent disability and secondary negative health and personal consequences of chronic pain,” said Rollin M. Gallagher, MD, MPH, deputy national program director for pain management for the VA and clinical professor of psychiatry and anesthesiology at Penn Pain Medicine, University of Pennsylvania.

Clark added that the severity and the breadth of the problem have been aggravated by the prevalence of multiple tours of duty for many service members, including weekend National Guardsmen who can be older with families and jobs, a situation not seen in previous US conflicts.

Gallagher further noted that the VA’s pain care challenge is magnified by a 90% injury survivor rate from these conflicts, compared with only 40% in the Vietnam War. VA clinicians are now challenged to manage pain in blast survivors with one or several other consequences of blast, such as head injuries causing mild to severe traumatic brain injury (TBI), physical disfigurement and social stigma, emotional trauma, and often posttraumatic stress disorder (PTSD).

“The evidence is compelling that the symptoms of these comorbidities, as well as others such as substance abuse, depression and sleep problems, overlap significantly,” Clark explained, “and there is ample reason to believe they will not respond as favorably to traditional interdisciplinary pain treatment when compared to other groups of former soldiers.”

“The need is for a fully integrated, system-wide and evidence-based continuum of pain management from the battlefield to military hospitals to our community care facilities with increased pain care access, state-of-the-art treatment protocols, high competence levels for care providers, and the integration of pain education into professional training,” said Gallagher.

Gallagher pointed out that earlier and more aggressive acute pain treatment intervention is being provided closer to the battlefield. This advancement in battlefield care may help to prevent or lessen longer-term disabilities and secondary consequences of chronic pain.

“Present research will tell us definitively what we know from our clinical experience—that early blockage of neurological pain impulses to the spinal cord and brain close to the site of injury using peri-neural catheters and nerve blocks, along with more aggressive analgesic treatment, is proving more effective than the traditional method of just morphine injections,” he said. “And the soldiers appreciate the earlier intervention.”

VA’s Integrated Pain Care Approach

The overlapping disorders of pain, mild TBI, and PTSD among returning soldiers is leading to new initiatives at the VA.

“The [Veterans Health Administration] (VHA) has directed a new pain management strategy with a stepped-care model that offers a comprehensive continuum of treatment from acute pain at injury to longitudinal management of chronic pain, and this approach is now being considered by the Department of Defense in collaboration with the VHA,” Gallagher said. “The goal is to reduce pain and suffering and improve the quality of life for our returning Iraq and Afghanistan service men and women suffering acute and chronic pain.”

“The use of silo treatment pathways in chronic pain treatment is insufficient, less effective and less efficient,” Clark said, “because they typically focus solely or primarily on pain-related symptoms and either exclude those with concurrent PTSD and/or TBI symptoms or occasionally refer them to relevant specialty programs for simultaneous but independent treatment.”

As an example of the VAs health care system refocus, Clark reviewed current work at the Tampa VA facility by use of a single-team approach and a postdeployment behavioral health program with specialties in behavioral medicine, pain, PTSD, TBI, substance abuse, physical therapy, and case management.

“Our objectives are to maximize function and life adjustment, prevent symptom development or exacerbation, and reduce stress through a single team effort,” Clark said. “Treatment involves established and modified cognitive
Physical and Psychological Functioning Appear to Improve Patient Coping With Disease-Related Pain

Growing evidence suggests that the way in which individuals cope with and appraise disease-related pain, such as arthritis or cancer, is related not only to their experience with pain but also to their physical and psychological functioning. New research was presented at a plenary session of the American Pain Society (APS) annual scientific meeting in Baltimore, Maryland, in May.

In his presentation titled “Pain Coping in Disease-Related Pain: Current State of the Science,” Francis J. Keefe, PhD, professor of psychiatry and behavioral sciences and associate director for research in the Duke Pain and Palliative Care Initiative at Duke University Medical Center, described the conceptual background for research on pain coping and appraisal, especially in disease-related pain, and provided an in-depth evaluation of key themes on pain coping that have emerged from important recent research studies.

“We are clearly observing that studies of coping do help us better understand variations in pain and disability,” Keefe was quoted in an APS news release. “It’s important to remember that any type of pain has both mental and physical components to it.”

“From recent burgeoning literature we have, such as examining studies in GI cancer and osteoarthritis patients,” he continued, “what seems to be especially important in comprehending persons with disease-related pain is catastrophizing, or the tendency to focus on and exaggerate the threat value of painful stimuli and negatively evaluate one’s own ability to deal with pain. We already know that pain catastrophizing is key to understanding chronic pain.”

Keefe said daily diary studies are yielding evidence and critical new insights into individual differences in pain coping. The evidence is also providing insight into the way in which treatment can alter the day-to-day relationship between pain and coping or mood.

Keefe noted that personal data assistants (palm-held devices such as smartphones) may offer an effective platform for assessment and, ultimately, treatment of pain.

“More definitive research is needed on pain mechanisms underlying coping,” Keefe concluded. “In a recent study of cortical responses to pain and the relationship to catastrophizing, it was evident that a cortical vigilance network is engaged during mild pain. But with more intense pain, a diminished prefrontal cortical modulation impedes disengaging from and suppressing pain. Understanding these underlying mechanisms can help to develop more effective and specific pain therapies in the future.”

Eating and smoking are pain-coping efforts that seem to be self-defeating, added Keefe in describing a vicious cycle associated with the eating and pain relationship.

“Increasing food intake may provide acute relief of pain and distress, but it creates long-term problems such as weight gain, increased pain, inflammation and disability,” he said.

Keefe also discussed the role of the spouse or partner of the patient who is coping with disease-related pain. His plenary session talk recounted new research initiatives examining coping and appraisal in patient-partner dyads, the relationship of pain coping and appraisal to acceptance, and the role of culture in shaping coping efforts.

“Basic elements of coping-skills training (CST) protocols include helping patients reconceptualize pain and pain control, systematic training in coping skills—such as relaxation, activity pacing, cognitive restructuring, distraction and imagery—and behavioral rehearsal and guided practice,” Keefe said.

He cited key findings from a recent review of cancer pain studies that showed CST interventions using imagery or hypnosis yielded consistent beneficial effects, although the ideal components and tailoring of CST remain to be defined.

Keefe summarized new directions for patients and caregivers in psychosocial interventions, including both partner-assisted and couples-based approaches. Key findings of one pilot study involving relationship enhancement for breast cancer patients and their partners showed patient improvements in symptoms (pain, fatigue, nausea), functional well-being, self-image, body acceptance, and relationship functioning. Meanwhile, caregiver enhancements included psychological distress reduction and posttraumatic growth.

Promising results are also evident in a pilot study of yoga practice for women with metastatic breast cancer, he reported.

“When women practiced more a given day, they experienced more improvements the next day in pain, fatigue, vigor, acceptance and relaxation,” Keefe said.

Keefe concluded, “Developing and refining interventions to enhance pain coping can lead to major advances, including pain prevention, an improvement in the quality of life, and reducing the suffering of many individuals having disease-related pain. I believe there is even more important progress that lies ahead.”
1. Low back pain (LBP)
   A. has a lifetime prevalence of 70%
   B. is the second most common medical condition in the United States
   C. may be experienced by 84% of the population at some time
   D. all of the above

2. A radicular component is the most common cause of LBP.
   A. True
   B. False

3. The most important factor in delineating the cause of LBP is
   A. history and physical examination
   B. radiologic studies
   C. laboratory reports
   D. assessment of pain intensity

4. Cauda equina syndrome
   A. requires immediate treatment
   B. is associated with bilateral radicular pain
   C. exhibits loss of bowel and bladder sphincter tone
   D. all of the above

5. Which one of the following statements regarding LBP is true?
   A. Approximately 50% of cases are attributable to overuse of muscles.
   B. Osteoporotic compression fracture occurs in approximately 4%.
   C. Spinal stenosis is a very common cause.
   D. Degenerative age-related changes are seen in at least 70% of cases.

6. Disc herniation is most likely to occur at L5-S1.
   A. True
   B. False

7. Most cases of LBP resolve spontaneously.
   A. True
   B. False

8. Radiographic studies
   A. should be ordered in all patients with LBP
   B. often reveal significant pathology in asymptomatic patients
   C. are essential for diagnosis in patients with radicular pain lasting more than 1 week
   D. are not indicated if the clinical picture suggests systemic disease

9. Which of the following statements regarding trigger points is/are true?
   A. They are usually multiple.
   B. They can be described as taut bands, ropy, and tender to the touch.
   C. Pain may radiate from these points to broader areas.
   D. All of the above

10. Spinal cord stimulation
    A. is a first-line therapy for patients with radicular pain
    B. depends on small-fiber stimulation
    C. requires a trial of stimulation before permanent implantation of the stimulator
    D. achieves good to excellent results in 90% of patients
Video Games and Virtual Reality Experiences Prove Helpful as Pain Relievers in Children and Adults

Virtual reality (VR) is proving to be effective in reducing anxiety and acute pain caused by painful medical procedures and could be useful for treating chronic pain, reported researchers at the American Pain Society (APS; www.ampainsoc.org) annual scientific meeting in Baltimore this past May.

When children and adults with acute and chronic pain become immersed in video game action, they receive some analgesic benefit.

“Virtual reality produces a modulating effect that is endogenous, so the analgesic influence is not simply a result of distraction but may also impact how the brain responds to painful stimuli,” said Jeffrey I. Gold, PhD, associate professor of anesthesiology and pediatrics at the Keck School of Medicine, University of Southern California, and director of the Pediatric Pain Management Clinic at Children’s Hospital of Los Angeles. Gold was quoted in an APS news release regarding his presentation.

“The focus is drawn to the game not the pain or the medical procedure, while the virtual reality experience engages visual and other senses,” Gold said.

While moderating a symposium entitled “Virtual Reality and Pain Management,” Gold noted that the exact mechanistic/neurobiological basis responsible for the VR analgesic effect of video games is unknown. However, he said that a likely explanation is the immersive, attention-grabbing, multisensory, and gaming nature of VR.

These aspects of VR may produce an endogenous modulatory effect, which involves a network of higher cortical (e.g., anterior cingulate cortex) and subcortical (e.g., amygdala, hypothalamus) regions known to be associated with attention, distraction, and emotion. Studies measuring the benefit of VR pain management, therefore, have used experimental pain stimuli, such as thermal pain and cold pressure tests, to turn pain responses on and off as subjects participate in VR experiences.

“In my current NIH-funded study, I am using functional magnetic resonance imaging to measure the effects of VR on experimental pain,” Gold said. “The objective is to measure the cortical regions of interest involved in VR, while exposing the participant to video racing games with and without experimental pain stimuli.”

Lynnda M. Dahlquist, PhD, a clinical child psychologist and professor of psychology at the University of Maryland, Baltimore County, reviewed her most recent laboratory research studies examining the use of virtual reality and other computer/video game technologies to provide distraction-based acute pain management.

The use of video games and VR distraction (VRD) technology for procedural pain management in both preschoolers and elementary to middle school children, reported Dahlquist, yielded promising results in increasing pain tolerance with potentially significant future clinical applications for more effective pain reduction techniques for youth with chronic and acute pain.

“However, more research is needed to know for certain if there is real world VRD application in such pain-generating procedures as cleansing wounds, cancer treatment, immunization, injections and burn care,” Dahlquist said.

Children interacting with a virtual environment by watching video games demonstrated a small pain tolerance improvement during exposure to ice-cold water stimulation, according to Dahlquist, but she recorded significantly greater pain tolerance for kids wearing specially-equipped video helmets when they actually interacted with the virtual environment.

“Our aim is to know what about VRD makes it effective in pain tolerance lab studies with children and what are the best ways to use it for optimum results,” she said.

She noted that in pain minimization, any distraction is better than none at all.

VRD’s effect on pain tolerance levels varied by children’s ages, indicating that age may influence how effective video game interaction will be.

“We must better understand at what ages VRD provides the greatest benefit in moderating acute pain and at what age, if any, that it can be too much or be limiting,” Dahlquist said.

In one study using video helmets for virtual environment interactivity, the special equipment had little positive impact with children ages six to 10, but for those over 10 years of age, “there was a much longer tolerance of the pain of the cold water exposure, leading us to further study to determine what aspect or aspects of cognitive development and neurological function account for this difference among youth.”

“Having dealt clinically for more than 15 years with children with acute and chronic illness,” Dahlquist said, “my genuine hope is that virtual reality activity can alleviate the anxiety of approaching pain and the pain experience itself.”

Coming Soon
- Patients With Chronic Pain: A Care Model
- Chemotherapy-Induced Peripheral Neuropathy Provides Treatment Challenges