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CME ARTICLE

Repetitive Strain Injury: Pain Management Considerations

Clifford Gevirtz, MD, MPH

Learning Objectives: After participating in this activity, the physician should be better able to:

1. Compare 3 evidence-based therapies for the treatment of repetitive strain injuries.
2. Diagnose common diseases that are associated with carpal tunnel syndrome.
3. Choose the appropriate evidence-based treatment for a patient with cubital tunnel syndrome.

Repetitive strain injury describes a group of disorders that develop as a result of repetitive movements, awkward postures, and/or the sustained application of force.[1] Although this disorder is common in adult workers and some occupation-related factors are associated with an increased risk of developing these disorders, factors that are not related to work can also play a part.

In This Issue

The American Board of Anesthesiology Pain Management curriculum addresses the need for practitioners to be able to identify and manage peripheral neuromuscular diseases such as carpal tunnel syndrome (CTS) and cubital tunnel syndrome. After completing this CME activity, the practitioner will be able to diagnose these disorders and prescribe evidence-based therapies to manage the pain associated with repetitive strain injuries.

Epidemiology

Repetitive strain injury typically occurs in adults between 30 and 60 years of age, with many patients reporting strains of the hands, wrists, arms, shoulders, or neck. Repetitive strain injury symptoms are common in the general population and are among the most frequent reasons for visiting the family physician. Studies have reported prevalence rates of CTS of 7% to 14%.[2-5] This syndrome is more commonly diagnosed in women than men.

Repetitive strain injury is most common in specific professions (eg, data entry workers or assembly-line installers) and in

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industrial settings. Factors that have been identified as increasing the risk of repetitive strain injury can be separated into physical, psychosocial, and individual risk factors. Evidence exists for the association between physical risk factors—such as repetitive movements, poor posture, and inadequate strength—and the occurrence of repetitive strain injury. The effects of work-related and psychosocial factors are not as clear as those of physical factors, although high workload, stress, and physical or psychologic demands increase the risk of injury.[6-9] Similarly, a lack of control over one's working environment has also been implicated.

Pathophysiology

There are several hypotheses for the pathophysiology of repetitive strain injury, but none has been strongly supported by scientific evidence. Despite initial distal presentation, this disorder seems to be a diffuse neuromuscular illness.[10]

Among the suggested mechanisms, the leading favorite is that overuse of tendons by repetitive loading causes repetitive strain injury.[11] Four pathologic mechanisms have been suggested for tendonitis:

1. Decreased elasticity of the tendon;
2. Friction between tendon and tendon sheath;
3. Tendon fatigue; and
4. Mechanically induced local temperature increase.

The function of peripheral nerves can also be impaired by mechanical overload. In CTS, for example, studies showed that specific forearm and wrist postures and external pressure on the

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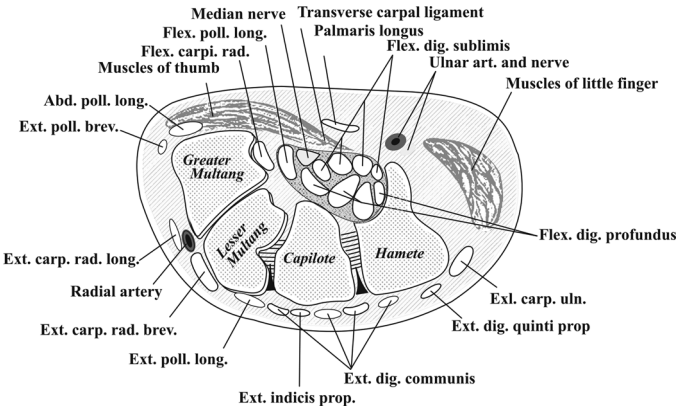

Figure 1. Drawing showing transverse section of the wrist. Source: Wikimedia Commons.

palm cause increased carpal tunnel pressure to levels at which nerve injury can occur. Pressure in the surrounding tissue, reduced elasticity, vibrations, and direct compression of the nerves can also reduce nerve conduction velocities. Figure 1 diagrams the wrist.

Diagnosis

Keith[12] published American Academy of Orthopaedic Surgeons (AAOS) practice guidelines on the diagnosis and treatment of CTS. These practice guidelines state:

> "The physician should obtain an accurate patient history. The physician should perform a physical examination of the patient that may include personal characteristics as well as performing a sensory examination, manual muscle testing of the upper extremity, and provocative and/or discriminatory tests for alternative diagnoses. The physician may obtain electrodiagnostic tests to differentiate among diagnoses. This may be done in the presence of thenar atrophy and/or persistent numbness. The physician should obtain electrodiagnostic tests when clinical and/or provocative tests are positive and surgical management is being considered. If the physician orders electrodiagnostic tests, the testing protocol should follow the American Academy of Neurology/American Association of Neuromuscular and Electrodiagnostic Medicine/American Academy of Physical Medicine and Rehabilitation guidelines for diagnosis of carpal tunnel syndrome. In addition, the physician should not routinely evaluate patients suspected of having carpal tunnel syndrome with new technology, such as magnetic resonance imaging, computed tomography, and pressure-specified sensorimotor devices in the wrist and hand."

It is especially important to note the admonition not to overevaluate or overinvestigate the patient. The amount of information obtained from these new technologies does not influence the choice of treatment, so it will be a waste of resources. This is one of the rare times where a specific suggestion not to investigate has been promulgated by a learned society.

Frequent Causes of CTS

Typing on a computer keyboard is probably the most common cause of CTS. Other causes include:

- Industrial sewing;
- Prolonged driving;
- Assembly-line work;
- Painting;
- Writing;
- Use of tools (especially hand tools, eg, awls; or tools that vibrate, eg, jackhammers);
- Participating in sports such as racquetball or handball; and
- Playing stringed musical instruments.

Medical Conditions Associated With CTS

Various medical problems have been associated with CTS, including:

- Bone fractures and osteoarthritis of the wrist;
- Acromegaly;
- Diabetes mellitus;
- Alcoholism;
- Hypothyroidism;
- End-stage renal disease and dialysis;
- Premenstrual syndrome;
- Pregnancy;
- Obesity;
- Rheumatoid arthritis;
- Systemic lupus erythematosus; and
- Scleroderma.

Surgical Versus Nonsurgical Treatment in CTS

The treatment options for patients with CTS are divided into 2 major groups: nonsurgical and surgical. In 1993, the American Academy of Neurology's official practice guidelines recommended treating CTS with noninvasive options first and considering surgery only if noninvasive treatment proved ineffective. In recent years, however, initial surgical management has gained support because of more accurate diagnostic techniques and the growing number of hand surgeons in the community. However, there is still controversy as to whether surgical or nonsurgical treatment should be chosen as the initial treatment of CTS.

It is especially important to note the admonition not to overevaluate or overinvestigate the patient.

The AAOS guideline[12] for the treatment of CTS recommends both nonsurgical and surgical treatments for early CTS

where there is no denervation of the median nerve, although it also recommends an initial course of nonoperative treatment. Surgery should be considered if there is clinical evidence of median nerve denervation or if the patient demonstrates an unwillingness to try conservative therapy.

In fact, the recent literature[13-16] demonstrates a trend toward recommending early surgery with or without median nerve denervation. In 2009, a study of 116 patients with CTS compared the treatment outcomes between an experimental group of 57 patients who received surgical management and a control group of 59 patients who received a nonsurgical treatment regimen of hand therapy and ultrasound.

The results showed that the surgical group achieved modestly better outcomes in hand function and symptoms at both 3 months and 1 year compared with the control group (level I evidence).

Only 3 conservative treatments are supported by a significant body of investigational evidence: splinting, corticosteroids, and ultrasound.

Another meta-analysis concluded that surgical treatment relieves symptoms better than splinting, but the evidence for surgical treatment being superior to corticosteroid injections is unclear (level I evidence). Therefore, much more research is needed to determine the best treatment for patients with mild to moderate symptoms, and to identify the patients who should forego conservative management and undergo surgery as the initial treatment.

Only 3 conservative treatments are supported by a significant body of investigational evidence: splinting, corticosteroids, and ultrasound. The AAOS recommends that when initial conservative treatment fails to resolve a patient's symptoms within 6 weeks, physicians should move on to another nonoperative treatment or undertake a surgical intervention.

Splinting

For patients with mild CTS symptoms, the simplest treatment is a wrist splint worn at night (Figure 2). Splinting has the advantage of being inexpensive and is associated with a minimal complication rate. The immobilization may decrease the pressure around the soft tissue in the carpal tunnel, which enhances blood circulation and relieves pressure on the median nerve. For this reason, splinting provides many patients with relief from the numbness and tingling sensation experienced at night or during extended periods of rest. For some patients, a splint may also be used during the day. The AAOS recommends that splinting be considered before surgery when treating CTS. Recent evidence-based studies[17,18] also support this suggestion. Specifically, research suggests that a splint that maintains the wrist in the neutral position may be more effective than a wrist cock-up splint. It should be considered as the initial treatment option before surgery, especially in mild or moderate cases.

Figure 2. Wrist splint for mild CTS symptoms. Source: Wikimedia Commons.

Corticosteroids

The AAOS recommends local corticosteroid injection (eg, Depo-Medrol 30 mg) when treating CTS before surgery is considered, and oral corticosteroids as a secondary option. The AAOS report also concluded that corticosteroids are more effective than nonsteroidal anti-inflammatory drugs (NSAIDs) and diuretics, but also have the potential for more serious adverse effects.

Further investigation is needed to determine the long-term outcomes of local corticosteroid injection and how many times and how frequently the injections should be repeated.

This conclusion is supported by a recent study by Marshall et al,[19] who concluded that local corticosteroid injections are more effective than oral corticosteroids for up to 3 months.

Another recent study indicated that local corticosteroid injection and NSAIDs with concomitant use of wrist splints might offer patients with CTS variable and effective treatment options for the management of functional scores and nerve conduction parameters.

As a result, corticosteroid treatment for CTS, particularly local injection, is effective for temporary relief of symptoms in many patients. However, the efficacy and duration of symptom relief with the corticosteroid injections are still unknown. Further investigation is needed to determine the long-term outcomes of local corticosteroid injection and how many times and how frequently the injections should be repeated.

Ultrasound

Ultrasound treatment consists of directing high-frequency sound waves at the inflamed area. The ultrasound waves are converted into heat in the deep tissues of the hand, and are presumed to open the blood vessels, allowing oxygen to be delivered to the injured tissue. As a result, it is suggested that ultrasound therapy may accelerate the healing process in damaged tissues. It is often

prescribed along with nerve and tendon exercises. The AAOS guideline[12] recommends ultrasound treatment of CTS. However, this recommendation was based on the results of only 2 studies, hence the low evidence level of this recommendation. To increase the evidence level of ultrasound treatment for CTS, further studies comparing an ultrasound group against a placebo group are needed.

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Surgical Treatment

There are several variations of carpal tunnel release (CTR) surgery. The 2 major types are open CTR (OCTR) and endoscopic CTR (ECTR). Regardless of selection of these treatment options, the most important thing is complete division of the flexor retinaculum to decrease pressure within the carpal tunnel.

Open CTR

Traditionally, OCTR was performed through a relatively large 4- to 5-cm longitudinal incision extending from Kaplan cardinal line distally, to beyond the wrist crease proximally. Over time, the size of this incision has gradually decreased, and most hand surgeons today perform primary OCTR through a 2- to 4-cm incision, which ends approximately 2 cm distal to the wrist crease (Figures 3 and 4).

OCTR has been shown to be an effective and relatively safe procedure, and is established as the standard surgical treatment for CTS. It has produced uniformly excellent results, with high patient satisfaction and a low complication rate. The outcome of this procedure can be complicated by scar tenderness, grip and pinch weakness, and pillar pain, which are all related to the incision.

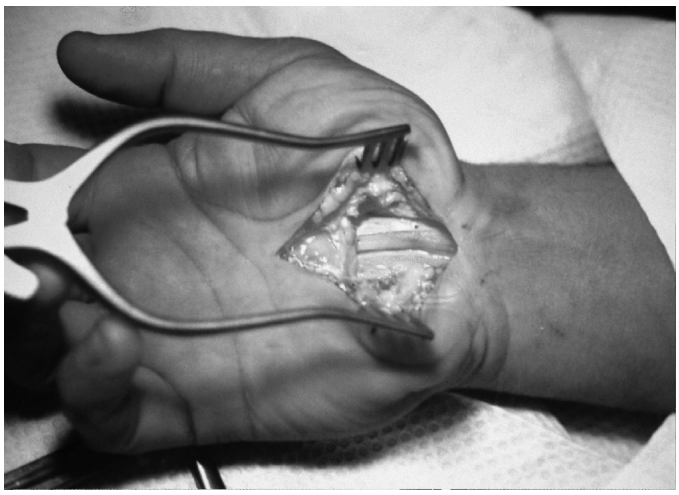

Figure 3. Carpal tunnel syndrome operation. Source: Harry Gouvas, MD, PhD, Wikimedia Commons, public domain.

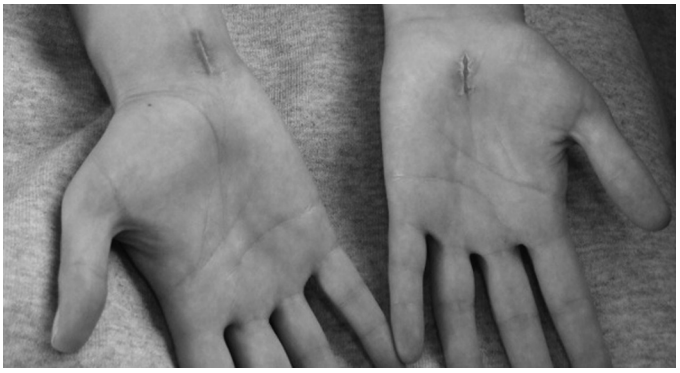

Figure 4. Scars from carpal tunnel release surgery. Two different techniques were used. The left scar is 6 weeks old, the right scar is 2 weeks old. A year later, the patient had fully recovered. Source: Henry K. Gerlach, Wikimedia Commons, public domain.

There are 2 recent publications concerning OCTR. The *Cochrane Database of Systematic Reviews*[20] concluded that there was no strong evidence supporting the need for replacement of standard OCTR by alternative surgical procedures for the treatment of CTS.

In contrast, the other study[21] compared conventional OCTR with the double-incision technique and showed that the limited open technique using the double incision was advantageous compared with the standard technique in tackling scar-related morbidities in terms of decreasing pillar pain and scar sensitivity.

Endoscopic CTR

ECTR refers to a method of performing CTR using an endoscope or arthroscopic device. This entails a less invasive procedure than standard OCTR. ECTR was invented to address the potential complications of OCTR by using smaller incisions placed away from the middle of the palm. It is assumed that preservation of the superficial fascia and adipose tissue over the flexor retinaculum allows faster recovery of grip strength, less scar tenderness and pillar pain, and earlier return to work. According to the AAOS guideline,[12] ECTR offers better outcomes than OCTR at 12 weeks after surgery in terms of pain relief, time until return to work, and wound-related complications.

Other Nonsurgical Therapy

Many other nonsurgical treatment options could provide pain relief. Carpal bone mobilization, 7 weeks of ultrasound treatment, and yoga have shown some benefit, but only small, underpowered trials were done.[22] Diuretic drugs, NSAIDs, vitamin B_6, magnet therapy, laser acupuncture, use of ergonomic keyboards, exercise, and chiropractic care have not yet shown symptomatic benefit when analyzed in rigorous controlled trials.[23-26]

Cubital Tunnel Syndrome

Treatment of cubital tunnel syndrome is generally conservative for at least 6 months. Conservative treatment in patients with

cubital tunnel syndrome aims for return to functional strength and mobility of the affected arm and consists of manual therapy, splinting, stretching exercises, and NSAIDs.

Surgery might be necessary if conservative therapies fail, although optimum surgical management is controversial. Of the surgical interventions, medial epicondylectomy provides the best symptom relief for patients with mild symptoms, and anterior subcutaneous transposition provides the least relief.[27,28]

Submuscular transposition is most effective for patients with moderate symptoms. For patients with severe cubital tunnel syndrome, the best treatment option is still unknown.

Conservative treatment of cubital tunnel syndrome consists of manual therapy, splinting, stretching exercises, and NSAIDS.

Lateral Epicondylitis: Tennis Elbow

Most patients with lateral epicondylitis are treated conservatively in primary care. Oral and topical NSAIDs provide short-term pain relief.

Corticosteroid injections are effective for short-term (≤6 weeks) pain relief, increase in grip strength, and overall improvement, but they do not provide intermediate or long-term effects.[29] Ultrasound can also reduce symptoms.[30]

Other treatment options for lateral epicondylitis include acupuncture (either needle or laser), orthotic devices, laser therapy, electrotherapy, exercises, and mobilization techniques, but the effectiveness of these therapies is unknown. Surgery is also a treatment option in patients with severe symptoms. Percutaneous tenotomy for lateral epicondylitis seems somewhat better than open tenotomy for improvement of disability and decreasing recovery time and return to work.[31,32]

Neck Pain

Patients with localized neck pain are first treated with nonsurgical interventions. Exercise therapy has some short-term benefit on pain and function for patients with neck pain.[33,34] No type of exercise (eg, strengthening, stretching, endurance, or eye-fixation exercises) can clearly be recommended over others. Differences in effect, if any, across types of exercise are small. Manipulation and mobilization are not useful on their own for mechanical neck disorders with or without headache. Intramuscular injection of lidocaine could be an effective treatment for some patients with chronic neck pain.[35]

Epidural injection[36] of methylprednisolone with lidocaine may be helpful for reduction of sick leave after 6 and 12 months for patients with chronic neck pain with radicular findings. For patients with cervicobrachial pain, radiofrequency denervation can provide pain relief for several months. Other commonly used treatment options for neck pain are a collar, NSAIDs, psychotropic medication, electrotherapy, and transcutaneous electrical nerve stimulation. Whether these interventions are effective is still uncertain.

Corticosteroid injections are commonly used for treatment of shoulder pain. Little evidence is available to guide treatment as to the number, site, and dose of injections.

Shoulder Pain

Corticosteroid injections are commonly used for treatment of shoulder pain.[37] Little evidence is available to guide treatment as to the number, site, and dose of injections. Subacromial corticosteroid injection for rotator cuff disease and intra-articular injection for adhesive capsulitis may be beneficial, although the effect is small and not well maintained. Corticosteroid injection may speed up return to work, as seen at 12 months' follow-up in one study.[38]

Physiotherapeutic interventions are also widely used for treatment of shoulder pain. Exercises, either alone or combined with mobilization, provide short-term recovery and long-term improvement in function.[39] Ultrasound and pulsed electromagnetic field therapy are possible treatments for shoulder pain, adhesive capsulitis, or rotator cuff tendonitis, but their benefits are unproven.

Conclusion

Repetitive strain injury is a frequently occurring disease about which surprisingly little is known. Evidence about risk factors is increasing, but the relative effects of such risk factors are not well understood, and commonly used diagnostic tests for specific strain injuries have no empirical support. Many treatment options exist and are commonly used in daily practice for patients with specific and nonspecific strain injuries, such as rest, medication, exercise therapy, physical therapy, behavioral therapy, occupational therapy, ergonomic intervention, or combinations of treatments, but there is a paucity of hard evidence for their support. Surgical intervention is better-studied in CTS, cubital tunnel syndrome, and lateral epicondylitis, but even here, gaps in our knowledge remain. ■

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Deep Brain Stimulation Research Analyzes Novel Treatment For Thalamic Pain Syndrome

Sonia Elabd, MA

Researchers at the Neurological Institute at Cleveland Clinic are conducting a research trial that investigates a novel approach using deep brain stimulation for managing severe, refractory thalamic pain syndrome.

A neurologic condition caused by damage to the central nervous system, thalamic pain syndrome can result from stroke, multiple sclerosis, tumor, Parkinson disease, or brain or spinal cord trauma. Most often, afflicted individuals describe the pain as an intense burning sensation combined with one or more of the following: sensation of pins and needles, aches, or sharp, stabbing pain.

The pain, which is usually constant and moderate to severe in intensity, can affect an entire half of the body or be restricted to limbs or appendages. Because of the differing causes, the pain can vary greatly in characteristics. Given the complexity of the pain, patients often find it challenging to describe the severity to clinicians, making diagnosis a challenge. Symptoms may not appear until months or years after the initial trauma, further complicating diagnosis and treatment.

Thalamic pain syndrome can result from stroke, multiple sclerosis, tumor, Parkinson disease, or brain or spinal cord trauma.

Pharmacologic therapies are often the first line of treatment. Anticonvulsants or tricyclic antidepressants are partially able to alleviate pain, but their effects can be accompanied by undesirable adverse effects. Transient benefits can be experienced through the use of analgesics, including nonsteroidal anti-inflammatory drugs, and narcotic analgesics.

"The prognosis is not very good for thalamic pain patients. They often fail to respond to pain medications. It's a difficult pain problem to treat," said Andre Machado, MD, PhD, assistant professor of surgery at the Cleveland Clinic Lerner College of Medicine at Case Western Reserve University, director of the Center for Neurological Restoration at Cleveland Clinic and a neurosurgeon at the Clinic's Neurological Institute.

Machado and colleagues are conducting a study in patients with thalamic pain syndrome. These patients have intractable pain that has not responded to conventional pharmacotherapy such as antidepressants.

By applying deep brain stimulation to the ventral anterior limb of the internal capsule and the adjacent ventral striatum (VC/VS), Machado hypothesizes, the therapy will help to relieve the affective aspect of patients' chronic pain and, therefore, decrease pain-related disability.[1]

"Chronic pain has not only a somatosensory aspect, but an affective and cognitive component as well, as proposed by Ronald Melzack's neuromatrix theory," said Machado.

"Other attempts to address the sensory component of pain have not been successful. With this approach, patients may still feel some degree of pain, but this will not impair them as much," Machado said.

This novel approach builds upon the understanding of chronic pain pathways and research on deep brain stimulation for selected psychiatric disorders.

Ronald Melzack, PhD,[2] emeritus professor of psychology at McGill University in Canada, who developed the McGill Pain Questionnaire, proposed that pain is a multidimensional experience of which sensory input is only one aspect. He suggested that the matrix is genetically determined and is the primary mechanism that generates the pattern in the brain that produces pain.[2]

Studies on a number of other surgical options, including gamma knife surgery of the pituitary, have been attempted with some measure of success. Deep brain stimulation of the periventricular gray area, sensory thalamus, or motor cortex showed some promise in a small number of patients with refractory thalamic pain syndrome. However, results were not as consistent as those observed in deep brain stimulation for movement disorders or neuromodulatory approaches for peripheral neuropathic syndromes.

This novel approach builds upon the understanding of chronic pain pathways and research on deep brain stimulation for selected psychiatric disorders.

"Our research would not have been possible without the experience with patients undergoing the same surgery to major treatment-resistant depression," said Machado, referring to a 2010 study published with Donald Malone, Jr, MD, chairman of the Department of Psychiatry and Psychology and director of the Center for Behavioral Health at Cleveland Clinic, and colleagues at Alpert Medical School at Brown University and Massachusetts General Hospital.

Their study evaluated deep brain stimulation of the VC/VS in patients with chronic, severe, treatment-resistant depression. From baseline to last follow-up (ranging from 14–67 months), 71% of patients had achieved at least a 50% decrease in Montgomery-Asberg Depression Rating Scale (MADRS). Similar decreases were noted from baseline to last follow-up in scores on the Hamilton Depression Rating Scale and the Global Assessment of Function Scale.[3]

Malone[3] wrote, "additionally, a substantial reduction in suicidality (as measured by mean MADRS suicide subscale

score) was observed by 1 month and was maintained through 12 months of follow-up."

Moreover, this work showed that targeting the VC/VS region is safe and effective in modulating behavior and mood. Malone is also working with Machado's group in the thalamic syndrome trial.

With funding from the National Institutes of Health, the current trial led by Machado marks the first use of deep brain stimulation of the VC/VS for management of central nervous system pain.

Machado's double-blind, randomized clinical trial is currently in the recruitment phase. Patients who have experienced severe pain for more than 6 months and are considered refractory to other treatments and surgical procedures undergo bilateral deep brain stimulation surgery, with implantation under sedation of 1 lead on either side of the brain. Each lead has 4 contacts placed from dorsal to ventral positions.

"Determining the optimal position of the leads was informed by our research in evaluating the positions of brain leads in patients with major depressive disorder, and observing the behavioral responses elicited from stimulation of these leads, and led to a understanding of the topography of the VC/VS region," said Machado.

The researchers vary the amplitude and pulse width while patients are alert and question the patient regarding mood, anxiety, and suffering to determine whether the correct neural circuit of the brain is being effectively modulated, while minimizing adverse effects.

Patients are randomized to receive 3 months of active or sham stimulation and then crossed over for an additional 3 months. Effectiveness of deep brain stimulation on behavioral and emotional responses will be measured monthly. After the 6-month evaluation period, patients will undergo 18 months of open-label stimulation.

Because of the difficulty in measuring pain relief in patients with severe chronic pain, Machado will use the visual analog scale only as a secondary outcome measure. The primary outcome measure is the Pain Disability Index to evaluate how much deep brain stimulation of the VC/VS region can alleviate pain-related disability. ■

References

1. Machado AM, Haber S, Sears N, et al. Functional topography of the ventral striatum and anterior limb of the internal capsule determined by electrical stimulation of awake patients. *Clin Neurophysiol*. 2009;120(11):1941-1948.
2. Melzack R. Pain and the neuromatrix in the brain. *J Dent Educ*. 2001;65(12):1378-1382.
3. Malone DA, Jr. Use of deep brain stimulation in treatment-resistant depression. *Cleve Clin J Med*. 2010;77(suppl 3):S77-S80.

Mindful Meditation for Chronic Pain Sufferers May Have Positive Effect

Sonia Elabd, MA

An increasing body of evidence has accumulated over the last decade indicating that mindful meditation helps to improve psychologic well-being and can help to relieve symptoms associated with a number of diseases and chronic conditions, including fibromyalgia and chronic lower back pain.

Mindfulness-Based Stress Reduction (MBSR), a type of meditation that teaches patients to be more aware of the present through gentle stretches, breathing, and yoga, has been shown to help chronic pain sufferers cope with pain. First developed in the 1970s by Jon Kabat-Zinn, PhD, founder of the Center for Mindfulness in Medicine, Health Care, and Society, at the University of Massachusetts Medical School in Boston, MBSR is now taught in many leading medical centers across the country.

Through an 8-week course, "individuals are taught to practice mindfulness meditation and mindful movement/gentle stretching and yoga as ways to become more aware, more present, and more relaxed as they face the stress of their own lives," according to Jeff Brantley, MD, director of the Mindfulness-Based Stress Reduction Program at Duke Integrative Medicine in Durham, North Carolina.

Early studies on different types of pain have yielded promising results in decreasing levels of pain, elevating mood, and increasing mobility in patients with chronic pain. These studies have been limited in scope and have varied in the type of chronic pain studied. Therefore, more research is needed on the effects of MBSR on different pain conditions.

In addition, the mechanism of action for MBSR is poorly understood. A study published earlier in 2011 by researchers at Harvard Medical School, University of Massachusetts Medical School, and the Bender Institute of Neuroimaging at the Justus Liebig Universität Giessen in Germany, may shed more light on the matter. After participating in the 8-week MBSR course, changes in the gray matter of the hippocampus of test group subjects were detected using MRI.[1]

No change was noted in the control group. Significant increases in gray matter were also observed in the posterior cingulated cortex, temporoparietal junction, and the cerebellum. The changes in gray matter could result from repeated activation of those brain regions.

The authors stated, "It should be noted also that MBSR is a multifaceted group program and some positive effects may result from components not specific to meditation or mindfulness, such as group social interaction, stress education, or gentle stretching exercises." ■

Reference

1. Hölzel BK, Carmody J, Vangel M, et al. Mindfulness practice leads to increases in regional brain gray matter density. *Psychiatry Res*. 2011;191(1):36-43.

Class I Recall: Medtronic SynchroMed II

Medtronic, Inc. – Neuromodulation (Minneapolis, MN) continues its class I recall of **Medtronic SynchroMed II**, model 8637, supplied in 20 ml or 40 ml reservoir size, sterilized using ethylene oxide (Recall # 3043-2011).

The firm is updating information regarding the potential for reduced battery performance that can lead to sudden loss of therapy in a small percentage of Medtronic SynchroMed II Implantable Infusion Pump models 8637-20 and 8637-40, distributed between May 2004 and July 8, 2011.

The initial communication was in July 2009. The purpose of the current recall communication is to update the scope and occurrence of this issue and to emphasize previously communicated patient management recommendations. The firm is not retrieving the device from the field or recommending prophylactic replacement of the pump.

Medtronic has posted a device identification page at http://wwwp.medtronic.com/ProductLookup/lookup.html?faId=222&alId=242&preview=false. Serial numbers are also available at http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfRES/res.cfm?id=102261. The total number of devices affected is 139,653 (105,002 in the United States and 34,651 elsewhere.

The MedWatch safety summary is available at http://www.fda.gov/Safety/MedWatch/SafetyInformation/SafetyAlertsforHumanMedicalProducts/ucm271510.htm, the recall notice at http://www.fda.gov/MedicalDevices/Safety/RecallsCorrectionsRemovals/ListofRecalls/ucm271492.htm, and the firm's press release at http://wwwp.medtronic.com/Newsroom/NewsReleaseDetails.do?itemId=1310137598665&lang=en_US.

Contact: Medtronic, Inc. – Neuromodulation, 7000 Central Ave NE, Minneapolis, MN 55432-3568; Ph.: 800/510-6735.

Letter to the Editor

Editor's note: *Topics in Pain Management* welcomes letters and comments from readers. The September issue of *TPM* (Vol. 27, No. 2) contained a CME article on the Risk Evaluation and Mitigation Strategy (REMS) for Onsolis, a rapid-onset, transmucosal fentanyl formulation, as well as an interview with Russell Portenoy, MD, about the inconsistencies among the REMS for some drug classes and how the future of REMS may look.

The articles prompted a letter from June Dahl, PhD, professor of neuroscience at the University of Wisconsin School of Medicine and Public Health, about the impact of terminology used to refer to the short-acting opioid analgesics. Dahl has been involved for about 25 years in educational and advocacy efforts directed at improving pain management practices. In the late 1990s, she worked with The Joint Commission to incorporate pain assessment and management into the standards the commission uses to accredit the nation's health-care facilities.

Clifford Gevirtz, MD, MPH

Dear Dr. Gevirtz:

I was pleased that you addressed REMS in the September issue of *Topics in Pain Management*. I particularly enjoyed Dr. Portenoy's comments about the REMS for Onsolis. I was also pleased that he used terminology related to one aspect of opioid pharmacokinetics in a manner that accurately reflects the characteristics of these drugs.

It is very common for short-acting opioid analgesics to be referred to as immediate-release opioids. This has enabled manufacturers to distinguish between those drugs and the special formulations of short-acting acting drugs that have longer durations of analgesic action. These latter formulations may be called extended-release, sustained-release or controlled-release.

Classifying short-acting opioids as immediate-release drugs does not accurately reflect the absorption and distribution characteristics of these agents. As your readers know, it takes 45 minutes to an hour to achieve maximum blood levels and therefore a maximum analgesic response after ingestion of a short-acting opioid such as morphine or oxycodone. This is not immediate release.

Furthermore, there was rather immediate release (within 30 minutes) of some of the oxycodone from the original formulation of Oxycontin. Fentanyl is very quickly released from the transmucosal formulations of this drug that are available. I was pleased to see these referred to these as rapid-onset formulations, which accurately reflects the fact that the drug is quickly absorbed so one can get maximal analgesia in 15 minutes.

Clinicians must understand the pharmacokinetics of opioids, in particular the differences among them. I have no evidence that the use of immediate-release terminology results in poorer pain care. Nevertheless, it is an inaccurate description of the absorption characteristics of the short-acting drugs. I respectfully request that in the future, you consider using the term short-acting instead immediate release. There are now short-acting and long-acting opioids and the rapid-onset formulations. The rapid-onset formulations are shorter-acting than the other short-acting drugs, but describing them as ultra short-acting would be an inaccurate reflection of their duration of action. With all of these drugs, the onset and duration of action are important. But the short-acting drugs are not immediately released.

June L. Dahl, PhD

Topics in Pain Management CME Quiz

To earn CME credit, you must read the CME article and complete the quiz and evaluation assessment survey on the enclosed form, answering at least 70% of the quiz questions correctly. **Select the best answer and use a blue or black pen to completely fill in the corresponding box on the enclosed answer form.** Please indicate any name and address changes directly on the answer form. If your name and address do not appear on the answer form, please print that information in the blank space at the top left of the page. Make a photocopy of the completed answer form for your own files and mail the original answer form in the enclosed postage-paid business reply envelope. Your answer form must be received by Lippincott CME Institute by **October 31, 2012.** Only two entries will be considered for credit.

Online quiz instructions: To take the quiz online, go to *http://cme.LWWnewsletters.com,* and enter your *username* and *password*. Your *username* will be the letters LWW (case sensitive) followed by the 12-digit account number above your name on the paper answer form mailed with your issue. Your *password* will be 1234; this password *may not* be changed. Follow the instructions on the site. You may print your official certificate *immediately*. Please note: Lippincott CME Institute, Inc. *will not* mail certificates to online participants. **Online quizzes expire at 11:59 pm Pacific Standard Time on the due date.**

1. **Evidence exists for an association between all of the following physical risk factors and the occurrence of repetitive strain injury *except***
   A. repetitive movements
   B. poor posture
   C. inadequate strength
   D. low exterior temperature

2. **All of the following pathologic mechanisms have been suggested for tendonitis *except***
   A. decreased elasticity of the tendon
   B. friction between tendon and tendon sheath
   C. mechanically induced local temperature increase
   D. frostbite

3. **Typing on a computer keyboard is probably the most common cause of CTS.**
   A. True
   B. False

4. **According to AAOS practice guidelines, the physician should not routinely evaluate patients suspected of having CTS with new technology such as MRI or CT.**
   A. True
   B. False

5. **All of the following diseases have been associated with CTS *except***
   A. Hansen disease
   B. acromegaly
   C. diabetes mellitus
   D. systemic lupus erythematosus

6. **Corticosteroid injections for lateral epicondylitis are effective for short-term (≤6 weeks) pain relief, increase in grip strength, and overall improvement, but they do not provide intermediate or long-term effects.**
   A. True
   B. False

7. **Conservative therapy for cubital tunnel syndrome includes all of the following *except***
   A. manual therapy
   B. opiates
   C. splinting
   D. stretching exercises

8. **Which one of the following statements regarding surgical intervention in cubital tunnel syndrome is *false*?**
   A. Medial epicondylectomy provides the best symptom relief for patients with mild symptoms.
   B. Anterior subcutaneous transposition provides the least relief.
   C. Submuscular transposition is most effective for patients with moderate symptoms.
   D. For patients with severe cubital tunnel syndrome, the best treatment option is anterior subcutaneous transposition.

9. **Treatment options for lateral epicondylitis that have been mentioned in the literature include all of the following *except***
   A. acupuncture (either needle or laser)
   B. laser therapy
   C. cupping
   D. electrotherapy

10. **Epidural injection of methylprednisolone with lidocaine may be helpful for reduction of sick leave after 6 and 12 months for patients with chronic neck pain and radicular findings.**
    A. True
    B. False

NEWS IN BRIEF

Evidence Indicates Rapid Relief for Cluster Headaches From Suboccipital Cortivazol Injections

Suboccipital cortivazol injections can relieve cluster headaches rapidly in patients having frequent daily attacks—either chronic or episodic, according to a study published online in *The Lancet Neurology*.[1]

Larger studies will be needed to confirm safety and tolerability.

Suboccipital corticosteroid injections have been used for preventive treatment of cluster headaches, the authors noted, but very little quality data from clinical trials existed to confirm the efficacy of this treatment.

They conducted a randomized, double-blind, placebo-controlled trial at the Emergency Headache Centre in Paris, France, enrolling 43 adults between the ages of 18 and 65 years with more than 2 cluster headache attacks per day. Of the 43 participants, 15 suffered from chronic cluster headaches and 28 suffered from episodic cluster headaches.

Patients were randomized to receive either the treatment—3 suboccipital injections (48–72 hours apart) of cortivazol—or placebo. Both the cortivazol treatment and the placebo were given as add-on treatment to oral verapamil in patients with episodic cluster headaches and as add-on prophylaxis for those with chronic cluster headaches.

"Injections were done by physicians who were aware of treatment allocation, but patients and the evaluating physician were masked to allocation," the authors wrote.

All but 1 of the 21 patients who received cortivazol had a mean of 2 or fewer daily attacks after injections, compared with 12 of 22 controls. Patients who received cortivazol also had fewer attacks in the first 15 days of the study than did patients who received the placebo. No serious adverse events were reported. ■

Reference

1. Leroux E, Valade D, Taifas I, et al. Suboccipital steroid injections for transitional treatment of patients with more than two cluster headache attacks per day: a randomised, double-blind, placebo-controlled trial [published online ahead of print September 7, 2011]. *The Lancet Neurology.* doi:10.1016/S1474-4422(11)70186-7.

Coming Soon:

- Yoga as an Intervention for Low Back Pain

Typical Heel Lances in Neonatal Care of Preterm Infants May Have Long-Term Effects

British scientists studied the brain activity of 46 infants between the ages of 28 and 45 weeks of gestation to determine at what age infants distinguish between pain and normal touch.

By measuring the difference in their brain activity when they were tapped gently or jabbed in the heel with a lance, such as is typically performed for specific blood tests in most neonatal units, researchers determined that the infants' brains did not start to respond differently to the pain of the heel sticks until between about 35 to 37 weeks. These findings were reported in the September 27 issue of *Current Biology*.

"This is the first study to systematically map the maturation of tactile and nociceptive activity in the developing human brain from the extremely preterm stage (28 weeks) through to the age of normal full-term birth (≤37 weeks)," the authors wrote. "The aim was to understand how and when the circuitry required for touch and pain discrimination emerges in the human brain."

The findings could have implications in neonatal care, because evidence indicates that repeated painful stimuli during early infancy could disrupt normal development of central pain processing.

"Repeated noxious stimulation of the kind used in this study is a feature of neonatal intensive care," the authors wrote. "Our finding that noxious heel lance increases neuronal bursting activity in the brain from the earliest age raises the possibility that excess noxious input may disrupt the normal formation of cortical circuits and that this is a mechanism underlying the long-term neurodevelopmental consequences and altered pain behavior in ex-preterm children. In the adult, pain is a complex, subjective experience with sensory and affective components involving multiple brain regions. We propose that the transition from nonspecific neuronal bursts to specific evoked potentials is a first stage in the development of central pain processing. The timing of this change marks the functional maturation of cortical circuitry such that the human brain can discriminate noxious sensory input from other non-noxious sensory stimulation." ■

Reference

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