INNOVATIONS
IN SPINE & BRAIN TREATMENT
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New strategy for relieving migraine pain draws on spinal cord stimulation techniques

Migraine pain may be treatable using single-pulse transcranial magnetic stimulation (TMS), according to findings appearing in the August 2010 issue of the journal *Headache*.

TMS would be advantageous as a migraine treatment methodology for the reason that it is both nonpharmacologic and nonbehavioral as well as safe, the authors concluded after studying more than 20 years of accumulated clinical data involving TMS as a diagnostic tool to measure corticomotor excitation and inhibition of neurophysiologic properties in conscious subjects.

Estimates suggest that between 11 million and 25 million American adults suffer migraines, a chronic and frequently debilitating neurological disease that often produces severe headache. The article authors contend that an alternative such as TMS is much-needed because treatment of migraine at present is largely confined to placing patients on drug therapy and providing them with education about how to modify their behavior so as to preclude the onset of headache (or, failing that, to reduce the severity of the episode).

TMS, the authors note, works by inducing in the brain weak electrical currents to excite and depolarize neurons. These currents arise from a rapidly changing magnetic field applied to the skull.

Effective in majority of cases

What is intriguing about TMS is its similarity to spinal cord stimulation, which uses electrical current to provide patient-controlled analgesia on demand. The chief difference is that spinal cord stimulation (SCS) is a useful pain management option for the neck, back and lower extremities – especially when other therapies prove ineffective or (as with protracted narcotics use) unacceptably risky.

SCS is reported effective in approximately 60 percent of cases. It helps mainly those patients who suffer from failed back surgery syndrome, complex regional pain syndrome and refractory pain due to ischemia. SCS is given credit for significantly reducing these patients' pain medication requirements.

With SCS, pain is controlled through a process of induced paresthesia. How this occurs remains something of a mystery – the neurophysiologic mechanisms of action on the spinal cord stimulation have not yet been thoroughly identified. But, evidently, SCS alters the local neurochemistry in the dorsal horn, which has the effect of beneficially suppressing neuron hyperexcitability.

To achieve this, one must implant in the patient's epidural space an array of stimulating electrodes and, in the lower abdominal area or gluteal region, a generator that transmits electrical pulses to the electrodes. The generator can be powered internally or externally and is operated by a patient-held remote control.

SCS is not for everyone

To be deemed an appropriate candidate for SCS, a patient must have experienced no meaningful relief from pain following treatment with conservative therapies, must have no significant psychological issues that could contribute to the presence and persistence of pain and have successfully undergone a spinal cord stimulation trial. (Such trials typically last five to seven days, during which time the patient must report at least a 50 percent reduction in pain.)

Assuming an appropriate candidacy, the patient will then be scheduled for minimally invasive surgery to place the electrodes and to anchor them to the interspinal ligaments. There exist a variety of electrode types and array configurations for this purpose. The combination ultimately selected will be chosen on the basis of which provide the best paresthesia coverage to the painful area. (The objective is to have the area of paresthesia overlap fully the area of pain.) Currently, up to 16 electrodes can be placed: Options include placing two parallel sets of electrodes (each containing eight leads) or four sets (each containing four leads) at different sites bilaterally or vertically.

Once the electrodes are implanted, the pulse generator is positioned, anchored and connected. The site is then closed. Lastly, the stimulator is programmed by the surgeon to deliver a particular, patient-specific pattern of paresthesia-inducing stimulation.

Blocking pain along peripheral nerves

Related to spinal cord stimulation is stimulation of the peripheral nerves, accomplished by placing the electrodes along them instead of in the epidural space.

By stimulating nonpainful sensory pathways in the peripheral nerves, the

electrical current significantly attenuates the pain signals produced by conditions including diabetic peripheral neuropathy; ilioinguinal neuralgia; intercostal neuralgia; lateral femoral cutaneous neuropathy; occipital neuralgia; painful nerve injuries; peripheral vascular disease neuropathy; post-amputation pain; postherpetic neuralgia; post-thoracotomy syndrome; and trigeminal neuralgia.

Peripheral nerve stimulation (PNS) is reported to be safe, efficient and effective.

And, as with SCS, placement of a PNS device proceeds in the same manner of trialing, implanting and programming. For superficial peripheral nerves, such as the trigeminal and occipital nerves, individual leads are placed just under the skin, overlying the nerves, often using imaging-guided techniques. For larger and deeper peripheral nerves – especially those adjacent neurovascular structures – an open approach is typically employed in order to minimize risk of structural damage and to facilitate placement of the electrodes in the vicinity of the targeted nerve. (The question of whether appropriate coverage has been achieved is answered by intraoperative testing.)

The generator for a PNS device is conventionally placed in the upper arm or thigh, unless the pain condition to be addressed requires electrode coverage of the cranial nerves, in which event the more suitable site for the generator may be the subclavicular, subcostal or even the buttock region.

It occasionally happens that the pain originates in an area where PNS and SCS devices are not optimally effective. (Rule of thumb: SCS devices are generally better at addressing extremity pain, while PNS devices are better at addressing localized pain.) In such circumstances, the stimulator of choice may be a subcutaneous peripheral nerve stimulation (SPNS) device. This entails placement of electrodes in the subcutaneous space directly subjacent the region of pain. Rather than work on the large peripheral nerves, this arrangement is designed to stimulate the small, unnamed cutaneous peripheral nerves and so block the pain signals emanating from more than a specific, named peripheral nerve.

Conclusions

Spinal cord and peripheral nerve stimulation are safe and effective means of quelling pain in patients who suffer from failed surgeries of the back and a host of other neurological disorders.

Right in your own Wisconsin community are numerous patients who have been helped by spinal cord and peripheral nerve stimulation – and no doubt a great many more who perhaps could benefit from either or both. I can attest to that because, here in my neurosurgery practice, many SCS and PNS implantations have been performed over the years, with corresponding reductions in otherwise stubborn pain being the norm.

One of the things my Mayo Clinic training instilled in me is an abiding appreciation for technologies such as SCS and PNS implants and what they can mean for a frustrated patient tired of enduring pain that seems to defy other forms of treatment. Accordingly, I invite you to consider referring to me those patients who you believe might benefit from SCS or PNS. Please know that, when you do refer them to me, they will return to you feeling more confident about and satisfied with the care you routinely provide and arrange.

For additional information about spinal cord or peripheral nerve stimulation as a potential therapy for your challenging pain management patients, please call me at (414) 385-7150. My invitation extends as well to calling with regard to any question you might have concerning brain, spine and other neurological disorders.

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