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EDITORIAL

Perspective: Peripheral Nerve Stimulation and Peripheral Nerve Field Stimulation Birds of a Different Feather

Introduction

Spinal Cord Stimulation (SCS) therapy provides electrical current to the spinal tissues to modulate pain. For the past three decades, this Food and Drug Administration-approved procedure has been used to treat moderate-to-severe pain of the trunk and limbs [1].

SCS has positively impacted the life and function of thousands. In contrast, stimulation of the peripheral nervous system, also FDA-approved for limited use, is employed to treat neuropathic pain arising from peripheral nerve dysfunction. Two, distinct therapies exist: 1) Peripheral Nerve Stimulation (PNS) therapy, which provides stimulus to a named nerve that innervates an area and 2) Peripheral Nerve Field Stimulation (PNfS), which provides stimulus to nonspecific nerve fibers in an area of pain. The roles of these two therapies are currently a hotly debated topic in both the scientific and reimbursement arenas. We delineate the two peripheral nervous system procedures and discuss their respective roles in treating patients.

Peripheral Nerve Stimulation

PNS initially was described as an archaic and invasive procedure of an open surgical dissection, followed by placement of the stimulating electrode in the direct area of the exposed nerve target. A tissue graft was created with fascia to protect the nerve from a high-energy field. This technique was fraught with complications including trauma to the nerve; blood-flow constriction to the neural tissues; and the need to reoperate fairly frequently due to neural irritation, scarring around the wiring adjacent to the nerve or need to add additional electrodes because of potential tachyphylasis. In our experience, these devices often required revision or removal because of increased sensitivity or lack of stimulation.

Thankfully the procedure to deliver electrical current has improved in recent years, becoming less intrusive and reducing risks and recovery time. Now, we can place a lead adjacent to the nerve, using a percutaneous delivery approach guided by either direct nerve stimulation or radiological landmarks. Typical target nerves include the occipital, supraorbital, intercostal, median, and ilioinguinal. In the past few years some of us have also published results about new stimulating implant devices with these advantages: 1) much smaller cosmetic profiles, 2) direct contact with the nerve, and 3) a lower-cost external programming and power source. These new devices reflect an evolution towards better targeting specific nerves with greater ease and specificity. In addition, the new PNS therapy may use ultrasound to guide the lead and the needle, an approach that could drastically change how PNS is used going forward [2,3].

Although PNS is limited to the area of nerve innervation around the impacted nerve, sometimes it may also impact the sympathetic fibers in the region of stimulation. This regional impact, initiated at the targeted peripheral nerve, can be particularly helpful to patients with Complex Regional Pain Syndrome type II or patients with vasospasm related to nerve dysfunction.

PNS Requires:

1. A thorough understanding of the peripheral nervous system and the innervation of the region of the body targeted for treatment.
2. The ability to place the lead in a specific area of a peripheral nerve anatomical distribution.
3. The ability to anchor the lead to maintain stability of stimulation around the nerve.
4. The ability to provide long-term programming and management of the system.

Peripheral Nerve field Stimulation

PNfS is a growing area of neuromodulation characterized by ease of implant and minimized risks. This procedure is becoming a common choice for difficult and focal areas of pain. The implanter places a lead in the subcutaneous tissue to directly stimulate the cutaneous afferents (rather than a discernable nerve) involved in the pain process. By creating an electrical field around a “painful area” of neurons, the nociceptive pathways themselves are impacted. PNfS may theoretically operate as follows: impact local blood flow, block cell membrane depolarization, change neurotransmitter levels, and change the message at the spinal cord level. Investigators are debating the mechanisms, but many think PNfS may change the levels of localized and systemic endogenous endorphins, thereby impacting the nociceptive threshold in the target zone. One potential advantage of PNfS is the ability to create current cross-talk that stimulates a zone beyond any specific nerve. This allows the physician to be less specific in targeting a specific nerve.

Compared to PNS, PNfS Requires:

1. An adequate, but less robust understanding of the peripheral nervous system and all of its components;

2. Less technical skill, in that the lead does not have to be placed in a specific location based upon peripheral nervous system anatomy, but simply within the area of greatest discomfort;
3. Less need for rigid anchoring to a specific location with some accommodation for lead movement; and
4. The same ability to provide long-term programming and management of the system.

Important Points to Remember

Although PNS and PNfS have much in common, remember these points:

1. The two modalities require different techniques, skills, and strategies.
2. When we discuss education, we should distinguish the devices and procedures.
3. When we code and bill for the procedures, we should carefully distinguish them.
4. Peripheral techniques will continue to be developed, changing options for our patients. Recent advances have included self contained wireless devices that do not require any external power source. This will most likely lead to a revolution in the area of PNS implants.
5. We must be good stewards of these techniques and create protocols for their proper use.
6. Overutilization could lead to limited access for patients who really may benefit from this evolving technology so the time to differentiate the two is the present.
7. New advances in central stimulation including new waveforms, high frequency stimulation and targeted SCS of the dorsal root ganglion may make the need for PNS implants less common. Randomized prospective studies will help us determine the best options for patients going forward [4,5].

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