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PERIPHERAL NERVE STIMULATION FOR ACUTE VERTEBRAL COMPRESSION FRACTURE PAIN: A CASE REPORT

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Background: Vertebral compression fracture (VCF) pain can be debilitating, affecting daily activities and quality of life. This case presentation shows the utility of peripheral nerve stimulation (PNS) for acute pain relief in the setting of an acute VCF.

Case Report: This case is of an 84-year-old woman with osteoporosis and an acute T9 compression fracture reporting significant pain relief with 60-day PNS when medications and modalities failed to relieve pain. PNS is utilized for acute and chronic nerve pain with an expanding role for acute postoperative pain and chronic nociceptive, nociplastic, and neuropathic pain. This case report highlights the expanding role of PNS for managing acute pain.

Conclusions: This novel approach to addressing acute insufficiency fracture pain highlights a promising alternative to inadequately relieved acute pain with conventional medication management or augmentation limitations due to patient comorbidities.

Key words: Peripheral nerve stimulation, vertebral compression fractures, augmentation, acute pain, case report

BACKGROUND

Vertebral compression fracture (VCF) is the most common complication of osteoporosis, affecting over 700,000 Americans every year (1). VCFs typically occur in women after menopause when bone resorption supersedes bone formation. Risk factors include osteopenia, osteoporosis, older age, history of vertebral compression fractures or falls, inactivity, corticosteroid use, underweight, female sex, excessive alcohol consumption, smoking, vitamin D deficiency, and depression (2).

Conservative treatments include thoracolumbar paraspinal strengthening and thoracolumbosacral orthosis for acute fractures. Pain management includes nonsteroidal anti-inflammatory drugs, acetaminophen, lidocaine 5% patches, and calcitonin nasal spray for the acute pain. On occasion, opioid medications may be necessary. Risks of these medications include sedation, confusion, falls, and dependence. When function and quality-of-life measures are impaired, vertebral augmentation through kyphoplasty or vertebroplasty may help alleviate pain.

However, patient fragility and comorbidities deter spine surgeons and interventionalists from considering augmentation resulting in undue pain and suffering.

Peripheral nerve stimulation (PNS) is a novel therapy addressing neuropathic pain from trauma and other etiologies. A recent study (3) highlight PNS's evolving role in acute postoperative pain which could have potential therapeutic use for acute insufficiency fracture pain. We are not aware of any published literature exploring its utility for acute VCF pain.

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CASE REPORT

Written Health Insurance Portability and Accountability Act authorization and informed consent have been obtained from the patient for the publication of this case report.

An 84-year-old woman with osteoporosis underwent a T7 kyphoplasty 6 years before her presentation to the clinic. Two months before her presentation, she underwent a follow-up computed tomography (CT) showing compression deformities of T5, T6, and radiopacity of T7 consistent with the previous kyphoplasty. At that time, she was asymptomatic. One week before presentation, she developed an acute onset of a new, severe midthoracic pain radiating to her left side in a nondermatologic distribution. Her pain was aggravated with bending, standing, walking, and daily self-care activities. She visited an urgent care center where an intramuscular anti-inflammatory ketorolac injection was ineffective and she came to our clinic one week after pain onset.

She had a past medical history of hypertension, osteoarthritis, hypothyroidism, and hyperlipidemia. Her surgeries included a right shoulder arthroscopy and a right knee arthroscopy with subsequent total knee arthroplasty.

Her physical examination revealed paraspinal muscular tenderness at the thoracic and thoracolumbar junction with associated tenderness of the T9 spinous process. Lasegue's test was negative bilaterally. There was no motor weakness of the upper or lower extremities or any bowel or bladder dysfunction.

New thoracolumbar x-rays showed anterior wedging of the T9 vertebral body and the follow-up magnetic resonance imaging (Fig. 1) showed an acute T9 compression with mild loss of height that was not present on the CT completed 2 months before.

For the ensuing month, she continued to have pain nonresponsive to oral medications, and could not tolerate physical therapy. During her follow-up visit, vertebral augmentation, facet joint injection, and PNS were discussed, but given her age and comorbidities, she opted to undergo PNS instead of kyphoplasty or facet joint injections.

Implant Technique

The procedure was performed in an ambulatory surgery center where the patient was placed in a prone position under mild sedation. The spinous process, pedicles, and lamina at the T9 vertebral level were identified under fluoroscopic guidance. The skin and subcutaneous tissues were anesthetized with 1% lidocaine. A stimulating probe (SPR Therapeutics, Cleveland, OH) preloaded into a percutaneous sheath and assembly was inserted through the anesthetized tissues under fluoroscopic guidance targeting the medial branch nerve as it traverses the lamina medial and inferior to the zygapophyseal joint. Frequency and amplitude settings were adjusted to deliver stimulation to the medial branch nerve. Nerve target optimization was confirmed noting paresthesia generation in the paravertebral regions corresponding to the T9 level being stimulated as well as rhythmic thumping within the multifidi, the latter being confirmed via palpation at 100 Hz for sensory stimulation and 12 Hz for motor stimulation.

The stimulating probe was removed from the percutaneous sheath and a needle containing a fine-coiled PNS lead (SPR Therapeutics, Cleveland, OH) was inserted into the sheath. Frequency and amplitude parameters were retested to stimulate the medial branch nerve to ensure a similar response with probe stimulation. After confirmation, the needle was withdrawn, and the coiled lead was anchored at the skin using Dermabond (Ethicon, Inc., Somerville, NJ) with gauze and Tegaderm (3M Health Care, St. Paul, MN) to secure superficially. The procedure was repeated on the contralateral side for bilateral coverage (Fig 2).

Initial follow-up was completed 2 weeks after the procedure. The stimulator was removed 2 months after the procedure and the final visit was at the 3-month mark.

RESULTS

The patient reported > 60% improvement in pain at her 2-week postoperative evaluation. This relief persisted into 2 months and 3 months. Furthermore, substantial improvements in mood, walking ability, relationships with people, and sleep at 2-week, 2-month, and 3-month intervals were noted. The lead on the right was inadvertently removed with the dressing change. However, stimulation on the left lead was uninterrupted and her relief continued for the remaining 60-day period.

Pain scores and functional measures were noted prior to the stimulator trial using the Numeric Rating Scale(NRS-11) and the Brief Pain Inventory (BPI) short form (4). The scores were recorded before the procedure and at 2 weeks, 2 months (when the stimulator was removed), and 3 months (Tables 1 and 2).

NRS-11 scores showed > 50% reduction in pain and substantial improvement in measures, such as general

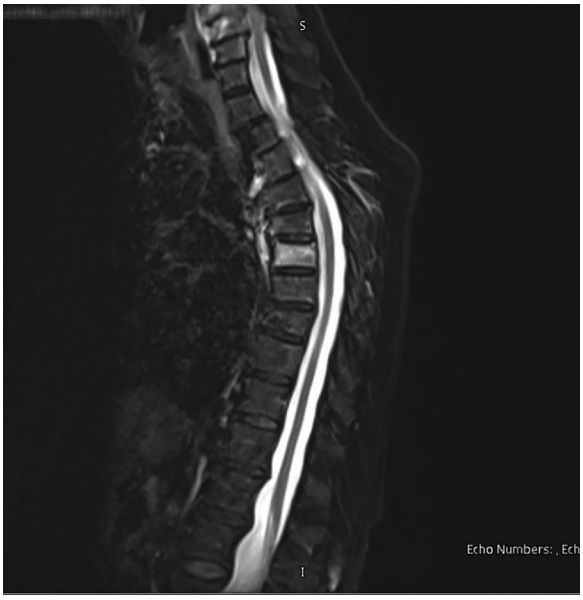

Fig. 1. MRI of an acute T9 compression fracture on a T2-weighted sagittal imaging. MRI, magnetic resonance imaging.

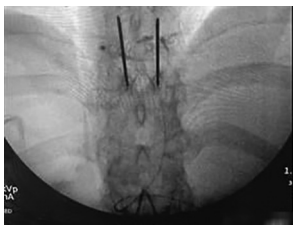

Fig. 2. Thoracic lead placement under fluoroscopic imaging.

activity, mood, ambulation, relations with people, with reduced interference with sleep, and enjoyment of life.

DISCUSSION

The case presented here illustrates the application of PNS for VCF in the acute setting. The clinical results show that the level of pain was significantly reduced although not eliminated. Kyphoplasty has certainly been effective but with significantly higher complications. PNS may rival facet injections with somewhat greater symptomatic relief.

The PNS treatment spectrum has expanded in the last decade. It has been utilized for cervical, thoracic, and lumbar medial branches, intercostal, ilioinguinal, iliohypogastric, lateral femoral cutaneous, femoral, sciatic, axillary, suprascapular, median, radial, ulnar, and occipital nerves. PNS is being explored for acute pain posttotal knee arthroplasty, postanterior cruciate ligament reconstruction, postrotator cuff repair, postamputation pain, and posthallux valgus osteotomy (5). Managing acute perioperative pain appropriately can prevent postoperative pain challenges and progression toward chronic pain.

Table 1. NRS-11 before and after implantation.

	Pre	Post	2 Mo	3 Mo
NRS-11	10	3	2	3

Abbreviation: NRS-11, numeric rating scale.

Table 2. BPI questionnaire before and after implantation.

BPI	Pre	Post	2 Mo	3 Mo
Pain at its worst in the last 24 h	10	3	2	4
Pain at its least in the last 24 h	3	0	1	2
Pain on the average	7	3	3	3
How much pain you have right now	4	0	1	3
How much relief you have received from pain treatments in the last 24 h	20%	60%	70%	70%
Pain interference with general activity	7	2	3	3
Pain interference with mood	9	2	0	0
Pain interference with walking ability	7	2	4	0
Pain interference with normal work	9	2	5	1
Pain interference with relations with other people	8	2	2	2
Pain interference with sleep	6	2	0	1
Pain interference with enjoyment of life	10	2	2	2

Abbreviation: BPI, brief pain inventory

CONCLUSIONS

This report shows PNS could be a safer and promising alternative for acute pain within the first 90 days in cases of inadequately relieved acute pain with conventional medication management or inaccessible augmentation due to patient comorbidities.

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