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Spinal Cord Stimulation for Management of Kienbock's Disease: A Case Report

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Background: Kienbock's disease, or osteonecrosis of the lunate, is associated with a history of pain and weakness of the affected wrist. To date, no reports have been published demonstrating use of spinal cord stimulation (SCS) for management of this disease. The patient provided HIPAA compliant informed consent for the inclusion of their clinical information in this report.

Case Report: A 31-year-old woman presented with a 10-year history of right wrist pain, absent of a history of trauma, that did not improve with conservative therapy, found to be secondary to avascular necrosis of the right lunate bone. A spinal cord stimulator trial and implant were subsequently performed, demonstrating a 75% reduction in pain intensity with paresthesia-free stimulation at 8-week follow-up and return to work.

Conclusions: SCS can help significantly improve symptoms and function in patients with Kienbock's disease.

Key words: Spinal cord stimulation, Kienbock's disease, vascular disease, case report

BACKGROUND

Kienbock's disease, or osteonecrosis of the lunate, was first described over 100 years ago by Dr. Robert Kienbock, an Austrian radiologist (1). Patients with Kienbock's disease present with a history of pain and weakness of the affected wrist, with symptoms present for a variable length of time and ranging in severity from mild/moderate to debilitating (1,2). Treatment options include conservative management, immobilization with a splint or cast, adjunctive analgesics, or surgery; however, no treatment has shown to be superior to another. Spinal cord stimulation (SCS) has been recognized as an important modality in the management of chronic pain conditions, with significant evolution in modes of stimulation offering improved patient pain relief and functional improvement (3). We present a case report of SCS applied to a patient with Kienbock's disease, and resulting in improved pain and function. This is, to our knowledge, the first case report of SCS being used for this condition as confirmed by a MEDLINE search, from 1967-2020, of the following terms: "spinal cord stimulation" + "Kienbock's"; "spinal cord stimulation" + "lunate" + "osteonecrosis."

CASE REPORT

The patient provided HIPAA compliant informed consent for the inclusion of their clinical information in this report.

A 31-year-old woman presented with a 10-year history of right wrist pain, absent of a history of trauma, that did not improve with conservative therapy. After sustaining a fall on her outstretched right wrist in March 2019, imaging revealed avascular necrosis of the right lunate bone and no acute fractures. Physical exam dem-

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onstrated tenderness to palpation over the whole wrist, with limited flexion and extension, but normal radial and ulnar deviation, pronation, and supination. There were no vasomotor or sudomotor signs or symptoms suggesting complex regional pain syndrome (CRPS) of the right wrist, and she did not meet the Budapest Criteria for diagnosis of CRPS at any point in her disease course. Computed tomography (CT) scan of the right wrist confirmed stage IIIA lunate sclerosis with positive signs of ulnocarpal impingement (Fig. 1). She again underwent focused hand and wrist physical therapy, avoiding heavy lifting and strenuous activities, and a wrist splint was applied. Intraarticular steroid injections did not offer any pain relief, and surgical options were considered, such as a radial shortening osteotomy and proximal row carpectomy, but not pursued secondary to limited preoperative functional capacity and anticipated challenges in postoperative pain management.

The patient was referred to our clinic, in March 2020, for consideration of pain management options, where she described a constant, shooting, burning, aching, stabbing, throbbing sharp pain worsening with activity, such as typing and lifting, demonstrating some features consistent with neuropathic pain (Douleur Neuropathic 4 > 4/10). Past medical history included polycystic ovary syndrome and previous history of ectopic pregnancy. Her only medication was prescription cannabis for pain management, obtained via dispensary, with low tetrahydrocannabinol concentration. Psychiatric assessment, which is routine in our program for all patients being assessed for neuromodulation, revealed mild depression (Patient Health Questionnaire-9 = 8/27), mild anxiety (General Anxiety Disorder-7 = 6/21), and minimal pain catastrophizing with a Pain Catastrophizing Scale score correlating to the 27th percentile. She also completed a 12-session pain self-management group program, which is also routine in our program for patients being assessed for neuromodulation. There were no psychiatric or mental health contraindications to proceeding with trial of SCS.

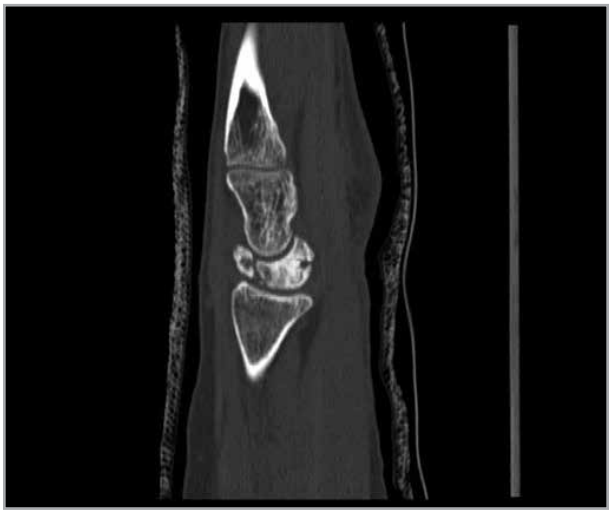

Fig. 1. Sagittal CT scan of right wrist demonstrating lunate sclerosis, consistent with diagnosis of Kienbock's disease.
CT, computed tomography.

Informed consent was obtained, and a percutaneous trial of SCS was performed, with epidural entry at the T5-T6 interspace and 2 electrodes advanced to the C5-C6 interspace, at midline and right of midline, respectively (Fig. 2). Two electrodes were used as is routine for our center, to improve programming options during the trial and optimize pulse-width modifications for paresthesia-based coverage. During the 10-day trial (routine for our center, as we cycle through paresthesia-based and subthreshold programming and trial of stimulation-off periods), the patient immediately noted a 50% reduction in pain with subthreshold programming, and a 60% reduction in pain with paresthesia-based stimulation. Her optimal trial stimulation parameters were amplitude of 4.1 mA, pulse width of 300 μs, and frequency of 70 Hz. She also noticed improved ability to type short paragraphs and stated that "psychologically, I feel like I have more energy and am more motivated." Patient-Reported Outcomes Measurement Information System-29 questionnaire domain T-scores (United States Department of Health and Human Services, Washington, DC) from pretrial to posttrial demonstrated meaningful change in domains of physical function, anxiety, depression, fatigue, and pain intensity. Based on her positive trial, the patient was consented to proceed with the full system implant with a Boston Scientific Precision Montage implantable pulse generator (Boston Scientific, Marlborough, MA). Optimal stimulation parameters for her full system implantation were amplitude of 5.1 mA, pulse width of 250 μs, and frequency of 40 Hz for paresthesia-based stimulation, with anode at the fourth contact of the midline electrode and cathode at the second contact of the midline electrode.

At her 8-week follow-up, the patient reported 75% reduction in pain intensity with her SCS delivering paresthesia-based stimulation (which was preferable to her over subthreshold programming options), and stated she completely stopped using cannabis for pain. The patient recommenced focused hand and wrist physi-

cal therapy, stating that she was gradually improving her hand strength, and has since tolerated increased typing loads. She states being more physically active and less fatigued.

At her one-year follow-up, the patient reported constant use of her SCS with paresthesia-based stimulation, with a sustained 50% reduction in pain intensity. She has noticed a significant increase in her physical function overall, demonstrated by increased ability to type, increased use of an exercise bicycle, and engaging in household activities, such as cooking and baking. She stated she is returning to work full time. Her main issue currently is mild implantable pulse generator site mobility due to her significant weight loss since her implant.

Overall, the patient believes SCS has offered her the most significant and sustained pain and functional improvement when compared to her previous pharmacologic, interventional, and multidisciplinary pain therapies.

DISCUSSION

The exact etiology of Kienbock's disease is uncertain, but anomalous peripheral vascular supply has been proposed as a primary contributing factor to its progression (1,2). Lunates supplied by a single arterial vessel, or those with limited intraosseous branching, are thought to be at increased risk of osteonecrosis. Venous congestion, within a dense plexus of small venous vessels, is also thought to cause lunate necrosis, but may be a secondary result of the disease as opposed to a primary contributor. Altered osseous anatomy and lunate morphology have also been suggested to cause Kienbock's disease. The potential vascular etiologies of Kienbock's disease raise the profile of SCS as a potential treatment modality, recognizing that SCS has been used for many years to treat peripheral vascular disease (PVD). SCS has also been shown to not only improve ischemic/neuropathic pain related to PVD, but also increase peripheral extremity perfusion as measured through transcutaneous carbon dioxide measurements or CT angiography (4). Therapies used for managing Kienbock's disease, such as cast immobilization or surgery, are aimed at restoring vascularity to the lunate, which can theoretically be achieved with SCS. For this patient with stage IIIA lunate sclerosis, the most evidence-based surgical interventions include direct revascularization procedures, such as vascularized pisiform transfer, pedicle transfer from the distal radius, or bone graft, all of which are thought to aid in new bone formation and primary bone healing by implanting viable osteoclasts and osteoblasts. We are unaware if these options were specifically considered in this patient; however, SCS has demonstrated success in augmenting microvascular perfusion for distal extremities (4,5).

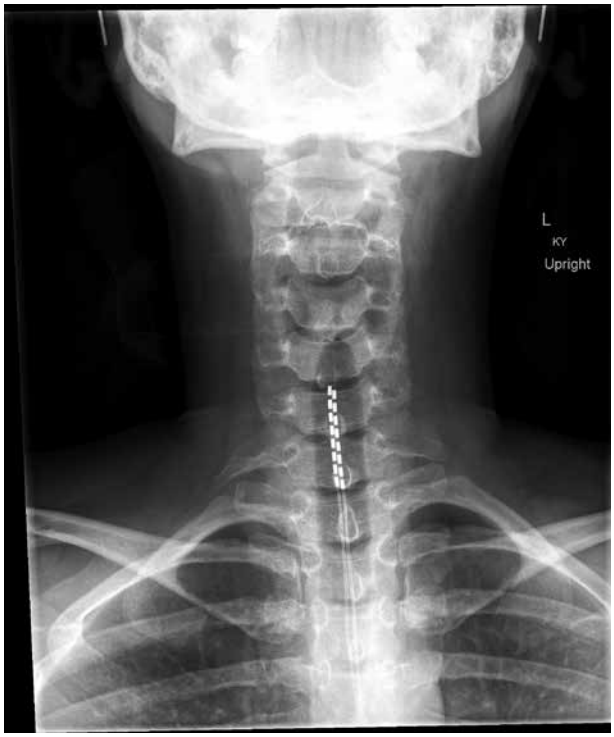

Fig. 2. AP radiograph of cervical spine showing placement of 2 percutaneous electrodes. Tip of leads is situated at approximately the C5-C6 interspace.
AP, anterior-posterior.

CONCLUSIONS

As more research continues to elucidate the role of vascular perfusion in the progression of Kienbock's disease, we also continue to understand how SCS can improve more than just pain, augmenting peripheral vascular perfusion at both micro- and macrovascular levels. Kienbock's disease remains a challenging disease to manage for our surgical colleagues, and understanding the potential role for SCS in its management can help significantly improve patients' symptoms and functions.

REFERENCES

1. Cameron T. Safety and efficacy of spinal cord stimulation for the treatment of chronic pain: A 20-year literature review. *J Neurosurg* 2004; 100:254-267.
2. Deer TR, Mekhail N, Provenzano D, et al. Neuromodulation Appropriateness Consensus Committee. The appropriate use of neurostimulation of the spinal cord and peripheral nervous system for the treatment of chronic pain and ischemic diseases. *Neuromodulation* 2014; 17:515-550.
3. Kumar K, Rizvi S. Cost-effectiveness of spinal cord stimulation therapy in management of chronic pain. *Pain Med* 2013; 14:1631-1649.
4. Lad SP, Petraglia FW, Kent AR. Longer delay from chronic pain to spinal cord stimulation results in higher healthcare resource utilization. *Neuromodulation* 2016; 19:469-476.
5. Robertson JT. Role of peridural fibrosis in the failed back: A review. *Eur Spine J* 1996; 5:S2-S6.
6. Palmer N, Guan Z, Chai NC. Spinal cord stimulation for failed back surgery syndrome – Patient selection considerations. *Transl Perioper Pain Med* 2019; 6:81-90.
7. Lombardi-Karl L, Aner MM. Percutaneous trial lead placement for failed back surgery syndrome. *The Neuromodulation Casebook* 2020; 3-12.
8. Choi HR, Fuller B, Bottros MM. Successful transforaminal epidural blood patch in a patient with multilevel spinal fusion. *Reg Anesth Pain Med* 2020; 45:746-749.
9. Okpareke I, Young AC, Amin S. Spinal cord stimulator placement in a patient with complex regional pain syndrome and ankylosing spondylitis: A novel approach with dual benefits. *A&A Case Rep* 2014; 2:117-120.
10. Kin K, Agari T, Yasuhara T, et al. The factors affecting the difficulty of percutaneous cylindrical electrode placement for spinal cord stimulation. *World Neurosurg* 2018; 113:e391-e398.
11. Ghaly RF, Lissounov A, Tverdohleb T, Kohanchi D, Candido KD, Knezevic NN. Spinal neuromodulation as a novel surgical option for failed back surgery syndrome following rhBMP exuberant bony growth in instrumented lumbar fusion: A case report and literature review. *Surg Neurol Int* 2016; 7:S668-S674.
12. Isu T, Kim K, Morimoto D, Iwamoto N. Superior and middle cluneal nerve entrapment as a cause of low back pain. *Neurospine* 2018; 15:25-32.
13. Yamauchi T, Kim K, Isu T, et al. Undiagnosed peripheral nerve disease in patients with failed lumbar disc surgery. *Asian Spine J* 2018; 12:720-725.
14. Zhang Y, Wood MJ, Gilligan C. Spinal cord stimulation in a patient with spinal epidural lipomatosis. *Pain Med* 2011; 12:377-381.