PAIN MEDICINE CASE REPORTS

ISSN 2768-5152

Volume 9, Number 1, pp. 67-69

Pain Relief in Mitochondrial Disorders: Use of Spinal Cord Stimulation in a Patient With NARP Syndrome

Augusta L. Kiepper, DO[1], Timothy Morgan, DO[2], and Christopher J. Mallard, MD[3]

Background: Neuropathy, ataxia, retinitis pigmentosa (NARP) syndrome is a mitochondrial disorder of the ATPase 6 gene. There is a wide variation of symptoms, but damage to the neuronal structures can result in chronic pain.

Case Report: A 31-year-old woman's chronic back and lower extremity pain related to NARP syndrome was successfully treated with dorsal column spinal cord stimulation (SCS).

Conclusions: SCS can be used as a means of pain management in patients with genetic etiologies. This case provides an example of treating symptoms related to genetic defects with simulation improving quality of life.

Key words: Case report, spinal cord stimulation, neuromodulation, causalgia, NARP syndrome, mitochondrial disease, chronic pain

BACKGROUND

Mitochondrial diseases are caused by either mutation in mitochondrial DNA (mtDNA) or nuclear DNA. Maternal inheritance directs mtDNA mutations; however, high mutation rates and heteroplasmy can result in phenotypical heterogeneity (1). Clinical severity directly correlates with mutation load (2).

Neuropathy, ataxia, retinitis pigmentosa (NARP) syndrome is a mitochondrial disorder most commonly resulting from a point mutation at base pair 8993 of the mitochondrial genome for the ATPase 6 gene in the electron transport chain. Other symptoms of NARP syndrome can include epileptic seizures, sensorineural hearing loss, cognitive impairment, diabetes mellitus, cardiomyopathy, and lactic acidosis (3). The same point mutation that can cause NARP syndrome can also cause Leigh syndrome. Leigh's syndrome is a mitochondrial disorder leading to encephalomyelopathy characterized by demyelination, gliosis, necrosis, and capillary proliferation in the brain, brain stem, and spinal cord. Most commonly, symptoms occur in infancy; however, they can manifest in childhood or adulthood. Phenotypic variability is the cardinal feature differentiating NARP from Leigh's syndrome (4). The risk of developing severe functional disability increases greatly when there is > 80% to 90% mutant load (5). Electromyography findings are predominantly sensory axonal neuropathy primarily affecting the lower extremities (4). There is no treatment for NARP and instead therapies primarily focused on symptomatic management.

Here we present a case of chronic back and lower extremity pain related to NARP syndrome with dorsal column spinal cord stimulation (SCS). Informed consent was not obtained due to the retrospective nature of chart review. The patient gave verbal consent for this case report to be submitted and published.

From: [1]University of Kentucky, Department of Physical Medicine and Rehabilitation, Lexington, KY; [2]Central Kentucky Pain & Spine, Paris, KY; [3]University of Kentucky, Department of Anesthesia, Lexington, KY

Corresponding Author: Christopher J. Mallard, MD, E-mail: cjmallard@uky.edu
Disclaimer: There was no external funding in the preparation of this manuscript.
Conflict of interest: Each author certifies that he or she, or a member of his or her immediate family, has no commercial association (i.e., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted manuscript.
Patient consent for publication: Consent obtained directly from patient(s).
This case report adheres to CARE Guidelines and the CARE Checklist has been provided to the journal editor.
Accepted: 2024-11-12, Published: 2025-02-28

CASE PRESENTATION

The patient is a 31-year-old woman with a past medical history of T8993G mutation in the ATPase 6 gene resulting in history of NARP syndrome. Her medical history was also significant for congestive heart failure, rodcone dystrophy, chronic fatigue, chronic pain, gait difficulties, migraines, depression, and attention-deficit/hyperactivity disorder. In childhood, she noted to have developmental delays during her school years. She was required to repeat third grade and be enrolled in special education from third grade to twelfth grade. The patient was not diagnosed with NARP until age 20 when her nephew tested positive for Leigh's syndrome prompting familial genetic testing. At the time of testing, the patient was diagnosed with NARP, and the patient's daughter was diagnosed with Leigh's syndrome.

The patient presented to the interventional pain clinic with complaints of chronic low back and bilateral lower extremity pain in 2023. The low back pain started in 2011 and was exacerbated by walking and lumbar extension. Initial history, physical exam, and imaging were consistent with axial spine pain from lumbar spondylosis. The patient's initial visit Oswestry Disability Index (ODI) was 24/50 or 48%, which placed the patient in the severely disabled category. Lumbar magnetic resonance imaging (MRI) showed lumbar spondylosis, mild degenerative changes at L4/L5, moderate bilateral neural foraminal narrowing, and mild anteroposterior canal diameter stenosis with a small synovial cyst posterior to the left lumbosacral facet joint. Previous conservative therapies, including chiropractic manipulation, heat, ice, gabapentin, nortriptyline, physical therapy, and osteopathic manipulation therapy, provided minimal relief. Due to the failure of conservative treatments, she underwent diagnostic lumbar medial branch blocks bilaterally at L4/L5, L5/ALA. She reported no relief after the procedure, and the low back pain increased. With conservative therapies and medial branch blocks failing, her NARP syndrome and potential neuronal damage were considered the likely cause of her pain

A trial of dorsal column SCS was then discussed as a potentional treatment option for her continued low back and lower extremity pain. The patient was deemed an appropriate candidate for a percutaneous SCS trial after psychological evaluation. The patient underwent a percutaneous SCS trial under moderate conscious intravenous sedation in a hospital outpatient department. Epidural space was accessed at T12-L1 interspace via paramedian approach with loss of resistance to air. Two 8-contact Abbott SCS leads (Abbott Medical, Plano, TX) reached the top of the superior endplate of T8. The patient tolerated the procedure well. The SCS trial lasted 5 days total. The patient reported 90% reduction in her pain and improvement in overall function and quality of life. During the trial, her sleep was 100% better and activity increased by > 75%. The patient was able to stand and walk for longer durations, which allowed her to be more involved in her daughter's care. Her posttrial ODI was 20/50 or 40%, which placed her in the moderate disability category.

The patient elected to move forward with permanent implant, which occurred 21 days after the trial ended. The implantation was performed at an ambulatory surgery center under monitored anesthesia care. Epidural space was accessed at T12-L1 via right paramedian approach. Both Tuohy needles accessed at T12-L1 to the right. The two 8-contact Abbott SCS leads were then placed at top of the superior endplate of T8 as in the trial. The implantable pulse generator selected was the Abbott Eterna™ (Abbott Medical, Plano, TX)by the patient for its size and MRI compatibility. At the first postoperative visit, the patient reported 90% pain relief with continued improvement in function. The first ODI postimplant was 22/50 or 44%.

CONCLUSIONS

To our knowledge, there are no prior case reports of SCS being used in the treatment of chronic pain in patients with NARP syndrome or Leigh's disease. This case shows the use of an SCS as a means of pain management in patients with genetic etiologies of chronic pain and therefore is an important demonstration of improvement in the quality of life a patient can experience.

REFERENCES

1. Akar HT, Sayar E, Sarıtas Nakip O, Sonmez E, Ozkan MB, Olgac A. Leigh syndrome due to MT-ATP6 variants: A case presentation and the review of the literature. *Mol Syndromol* 2024; 15:333-338.
2. Duno M, Wibrand F, Baggesen K, Rosenberg T, Kjaer N, Frederiksen AL. A novel mitochondrial mutation m.8989G>C associated with neuropathy, ataxia, retinitis pigmentosa - the NARP syndrome. *Gene* 2013; 515:372-375.
3. Rawle MJ, Larner AJ. NARP syndrome: A 20-year follow-up. *Case Rep Neurol* 2013; 5:204-207.
4. Gelfand JM, Duncan JL, Racine CA, et al. Heterogeneous patterns of tissue injury in NARP syndrome. *J Neurol* 2011; 258:440-448.
5. Kara B, Arikan M, Maras H, Abaci N, Cakiris A, Ustek D. Whole mitochondrial genome analysis of a family with NARP/MILS caused by m.8993T>C mutation in the MT-ATP6 gene. *Mol Genet Metab* 2012; 107:389-393.