

Exacerbation of Major Depression in a Patient with a Peripheral Nerve Stimulator

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Abstract

Mood disorders have been shown to influence the effectiveness of interventional treatment modalities for chronic pain. Likewise, spinal cord and peripheral nerve stimulators have been shown to improve depression scores in patients with chronic pain when effectively treating the pain. However, to our knowledge, a case of peripheral nerve stimulation worsening a patient's depression has yet to be described.

We present a case of a 62-year-old female with pre-existing bipolar disorder and left sided occipital neuralgia referred for interventional treatment. Greater occipital nerve block and radiofrequency neurotomy of the greater occipital nerve did not provide her long lasting effect. A peripheral nerve stimulator was then implanted over the greater and lesser occipital nerves. Pain relief was near 100% for four months. During this time the patient exhibited increased mood variability and worsening depressive episodes, as well as auditory and visual hallucinations. Deepening depression resulted in hospital admission for suicidal ideation, despite multiple adjustments to psychiatric medications. After ten months of worsened depression, and several adjustments to the stimulator settings, the stimulator was deactivated. Two weeks after deactivation, without changes in her medication regimen, subjective mood scores had risen dramatically with fewer episodes of suicidal ideation. Three months after deactivation, subjective grading of concentration, appetite, and mood had stabilized at much higher levels. The stimulator was ultimately explanted.

Peripheral nerve stimulation has been shown to effectively treat many neuropathic pain syndromes. This case suggests a causal relationship between stimulator implantation and mood alterations. We postulate that the exacerbation of this patient's depression may have been in part due to effective pain control. The neuropathic pain she previously experienced may have acted as a distractor that, when abolished, allowed her to focus more intently on her depression. In conclusion, peripheral nerve stimulation may negatively affect mood variability in a specific subset of patients.

Keywords: Headache; Neurostimulation; Occipital nerve stimulation; Occipital neuralgia; Peripheral nerve stimulation

Introduction

The association between chronic pain and depression has been well established for over thirty years [1]. Likewise, mood disorders have been shown to significantly influence the effectiveness of interventional treatment modalities for chronic pain [2]. It has been suggested that chronic pain is most associated with psychiatric conditions such as mood and anxiety disorders [3]. Successful treatment of pain may help in the improvement of underlying psychiatric illnesses [4]. Importantly, the presence of these psychiatric comorbidities is associated with increased disability [5]. Studies involving spinal cord and peripheral nerve stimulators have shown to positively affect depression scores in patients with chronic pain [6,7]. However, to our knowledge, a case of peripheral nerve stimulation worsening a patient's depression has yet to be described.

Case Report

We present a case of a 62-year-old female with preexisting bipolar disorder and left sided occipital neuralgia referred for pain control. Her symptoms began 10 years prior to presentation, when she was admitted to the hospital for intravenous dihydroergotamine treatment of her headaches. Acceptable pain control was maintained until 2011 when she presented to the Pain Clinic with increasing severity and frequency of her migraines. After unsuccessful pharmacologic treatment, including aripiprazole, quetiapine, bupropion, topiramate, venlafaxine,

and lamotrigine, she underwent left greater occipital nerve blocks with 80-100% relief of her headache. Relief was temporary, however, which led ultimately to further interventional treatment. Radiofrequency neurotomy of the greater occipital nerves provided sustained pain relief for approximately six months. Subsequent repeat ablation failed to relieve the pain. One year after initial presentation to the Pain Clinic, the patient underwent a peripheral nerve stimulator trial. One percutaneous octad lead provided by Boston Scientific TM was placed in the area of the left greater occipital nerve. After a successful week-long trial that provided 100% improvement in her pain, the patient was deemed a suitable candidate for permanent implantation. There was no complication during the trial period and there was no evidence of worsening of depression during the trial period. She subsequently underwent permanent implantation of an octad percutaneous lead and

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a conventional pulse generator, both provided by Boston Scientific TM.

Routine follow up with her psychiatrist after implantation of the peripheral nerve stimulator was uneventful. Her subjective mood score at that time was 7/10 on a self-rating scale, with 1 signifying the lowest mood and 10 the best. Her medication regimen included aripiprazole 10 mg daily, lamotrigine 200 mg daily, quetiapine 200 mg qHS, topiramate 125 mg AM and 150 mg PM, venlafaxine 300 mg daily, and bupropion 200 mg twice daily. It was over the next few months that the patient began to struggle with increased anxiety, depression, and suicidal ideation. Clonazepam 1 mg three times daily was added to her regimen, and quetiapine was increased to 300 mg at night without improvement. For the following four months multiple changes were made to her medication regimen without sustained improvement in disposition. Her subjective mood scores persisted at 1-5/10. Passive suicidal ideation became an issue. She also exhibited decreased concentration and appetite, insomnia, and auditory hallucinations. Up to this time her migraines had been reasonably well controlled. Four months after implantation, her headaches again became an issue, causing renewed pain. Ultimately, thirty days after the return of her headaches, the patient's struggle culminated in a hospital admission for active exacerbation of major depression and suicidal ideation (Figure 1).

After a short hospital stay the patient was discharged home. Up to this point, the stimulator settings had been unchanged. Her continued mood imbalance, despite multiple adjustments to her medication regimen, forced our attention toward the stimulator as a potential impetus for the depression, especially given her depression was controlled in the past. At six months post-implantation the stimulator was reprogrammed to its lowest settings. Her subjective mood interestingly improved after this adjustment. However, worsening headaches over the following two weeks called for increasing the stimulation to its previous level. She once again experienced deepening of her depressive symptoms, this time complicated by visual hallucinations and suicidal ideation. For a second time, the stimulator was turned off, followed by a concordant improvement in her mood. Subsequently, multiple escalations and reductions in stimulation were attempted with similar effect. Ultimately, a decision was made to turn off the stimulator for a more extended period of time, approximately three weeks. Two weeks after deactivating the stimulator, and despite return of her headaches, her mood scores improved dramatically, with significantly fewer episodes of passive suicidal ideation. No adjustments to her medications were

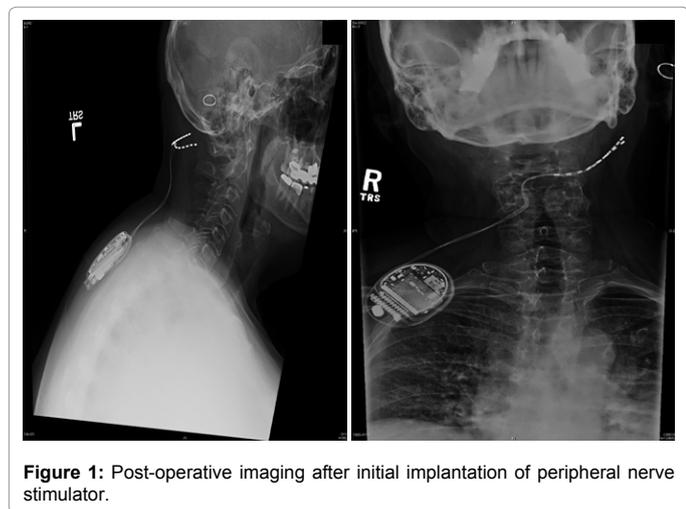


Figure 1: Post-operative imaging after initial implantation of peripheral nerve stimulator.

Pre-Implant	Post-Implant
Lamotrigine 200 mg daily	Lamotrigine 300 mg daily
Quetiapine 200 mg q HS	Quetiapine 300 mg q HS & 100 mg daily
Topiramate 125 mg AM & 150 mg PM	Topiramate 125 mg AM & 150 mg PM
Venlafaxine 300 mg daily	Venlafaxine 300 mg daily
Clonazepam 1 mg three times daily	Clonazepam 1 mg three times daily
Bupropion 200 mg twice daily	Bupropion 200 mg twice daily
Aripiprazole 10 mg daily	

Table 1: Medication regimen immediately prior to implantation, and at time of explanation one year later.

made during this period. Over the next 3 months she consistently rated her mood as a 6-7/10, despite noting multiple stressors. These were significant stressors, such as weathering a tornado that caused significant damage to her home, as well as dealing with internal family conflict and stealing. In spite of this, she reported improvement in sleep, appetite, energy and concentration, all of which stabilized while the stimulator remained dormant. Observing these interesting results, the stimulator was again turned off and on sequentially to specifically observe any temporally related mood alterations. With each decrease in the stimulator settings, the depressive symptoms dissipated; with each increase, even to sub-threshold levels, they returned. After confirming this effect multiple times, the decision was ultimately made to explant the device in its entirety. In the months following removal, she reported 10-15 headaches per month, for which she was thereafter being treated with intramuscular sumatriptan and nubain as needed. In spite of this her depression lessened. One month after explant of the device, she underwent repeat radiofrequency neurotomy of the greater and lesser occipital nerves, which provided satisfactory control of her headaches. She continued to follow up with the pain service on a regular basis, and consistently exhibited improved mood scores over the next six months (Table 1).

Discussion

Peripheral nerve stimulation has been shown to effectively treat many neuropathic pain syndromes [8]. Likewise, it has been specifically documented as effective treatment for many cases of chronic cluster headaches and migraines [9-11]. Importantly, these reports do not document complete relief headaches. On the contrary, effectiveness in these reports is classified simply as a reduction in headache days, decrease in overall intensity [12], or lower grading of overall disability [13]. An important modifying factor seems to be coexisting psychiatric disease. Studies dating back to the 1970s have established the impact of psychiatric comorbidities on patient outcomes [14], with depression being the foremost influential factor on the success of spinal cord stimulation [15]. The importance of prior psychosocial evaluation and expectations has been thoroughly documented [16,17]. A prospective study of over 100 patients undergoing lumbar surgery revealed that depression and anxiety were predictors of failure to return to work, failure to report improvement in pain or improvement in functionality [18]. Therefore it seems pertinent to ensure adequate treatment of psychosocial variables to maximize potential benefit from neuromodulation therapies.

Our case suggests a causal relationship between stimulator implantation and mood alterations. We postulate that the exacerbation of this patient's depression was a result of adequate pain control. The neuropathic pain she previously experienced may have acted as a distractor that, when abolished, allowed her to focus more intently on her depression and pre-existing social stressors. Shortly after worsening of her depression, many adjustments were made to her medications.

Aripiprazole was increased, then stopped, and then later reinitiated. Lamotrigine was increased as well. Quetiapine was initially increased 2 months after implantation without significant improvement in her depression. It was increased again after her hospitalization 5 months after implantation, but still she experienced persistent depression. Multiple dosage changes to clonazepam and trazadone also were ineffective. The only sustained improvement in both mood scores and functional status came with deactivation of the peripheral nerve stimulator.

An alternative rationale is that unreasonable expectations of post-implantation pain control could explain the mood deterioration. While her prior psychiatric evaluation and successful stimulation trial would argue against this, the validity of such pre-screening tools has been brought into question [15]. As Palmisani et al. postulate, a short term ONS trial cannot adequately reflect long term positive effects on a subjective, widely fluctuating pain phenomenon such as migraines. He notes that when one-month ONS trials were performed with semi-permanent implants, efficacy of subsequent permanent implantation was still only 47% [15]. Still widely accepted however, is the need for careful assessment of a patient's psychosocial dynamics [19]. Such consideration is warranted, given the risk of post-operative complications, including lead migration, infection, pain, and device failure [20]. Lead migration continues to be the primary untoward event, necessitating surgical intervention in 10%-12% of cases [21]. Moreover, infection rates range from 2%-10% in some studies [22,23]. Optimizing patient selection is vital in order to minimize unnecessary exposure to such risks.

Conclusions

Peripheral nerve stimulation may negatively affect mood variability in a subset of patients. These patients may be difficult to identify through conventional psychological evaluation prior to implantation. Therefore, providers must be aware of this untoward result. To the best of the author's knowledge, no similar reports of exacerbation of depression after peripheral nerve stimulator implant have been reported.

Conflicts of Interest

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