Neuromodulation: Technology at the Neural Interface

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A Review of the Factors and Outcomes of Institutional Interdisciplinary Neuromodulation Committees: A Multicenter Experience

Scott G. Pritzlaff, MD[1]; Michael Jung, MD, MBA[1]; Naileshni Singh, MD[1]; Juliann Cho, MD[2]; Matthew Skoblar, DO[3]; Manoj Jagtiani, MD[4]; Ravi Prasad, PhD[1]; Michael S. Leong, MD[4]; Vafi Salmasi, MD, MS[4]

ABSTRACT

Introduction: Neuromodulation represents one of the more advanced tools in the armamentarium of pain physicians. To optimize neuromodulation patient selection and management, an institutional interdisciplinary neuromodulation committee was created at each of two academic medical centers (University of California Davis [UCD] and Stanford University). The committee aims to collaboratively optimize neuromodulation candidates, to assess and minimize medical and psychologic risks, and to select the best device given a patient's pain condition. In this study, we present the methods and outcome data of the Neuromodulation Committee at the two institutions.

Materials and Methods: After institutional review board approval, we included all adult patients who were evaluated by the Neuromodulation Committee between 2017 and 2020 at two academic pain clinics. Patients with insufficient data were excluded from the study. A retrospective chart review was completed on 385 UCD and Stanford University patient committee reviews. Data collected from the chart review included demographics (age, sex), committee meeting results (proceed with trial/implant or decline), trial success, and implant rate.

Results: Of the 385 patients screened, the committees recommended proceeding with an implantable device (peripheral and neuraxial) in 337 patients (87.5%). Of the 278 patients recommended for neuraxial neuromodulation, 131 underwent trials with percutaneous leads (47.1%). Trials were successful (causing a ≥50% reduction in self-reported pain or improved function) in 108 patients (82.4%). The institutions completed 87 implants of 131 trials, representing a trial-to-permanent ratio of 66.4%.

Conclusions: The Neuromodulation Committee aims to identify optimal patients for neuromodulation, address procedural challenges, decrease adverse events, provide educational context for trainees, and improve patient-related outcomes. Patients who were recommended for neuromodulation and subsequently underwent intervention had high trial success rates for dorsal root ganglion stimulation and spinal cord stimulation. The findings indicate that such an approach can lead to neuromodulation success, especially at academic centers, by combining the expertise of both medical and psychologic professionals.

Keywords: Dorsal root ganglion stimulation, neuromodulation, patient selection, peripheral nerve stimulation, spinal cord stimulation

INTRODUCTION

Neuromodulation is an efficacious treatment for chronic pain.[1] Since the inception of spinal cord stimulation (SCS) in 1970 and its Food and Drug Administration approval in 1989 for trunk and extremity pain, its use has been increasing in frequency as a part of a multimodal strategy for treating refractory pain. The number of SCS implants has grown to 34,000 per year internationally.[2] The reasons for the gradual increase in SCS are multifactorial but likely can be attributed to the widespread adoption by pain physicians,

Address correspondence to: Scott G. Pritzlaff, MD, Department of Anesthesiology and Pain Medicine, Division of Pain Medicine, University of California Davis, 4860 Y St, Ste 3200, Sacramento, CA 95817, USA. Email: spritzlaff@ucdavis.edu

[1] Department of Anesthesiology and Pain Medicine, University of California Davis, Sacramento, CA, USA;
[2] Department of Anesthesiology and Perioperative Care, University of California Irvine, Orange, CA, USA;
[3] Jasper Spine Institute, Brick, NJ, USA; and
[4] Department of Anesthesiology, Perioperative, and Pain Medicine, Stanford University, Palo Alto, CA, USA

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neurosurgeons, and spine surgeons, especially when patients have failed surgical intervention. Improvements in SCS component technology, availability of novel waveforms, and remote programming have made neuromodulation significantly more accessible for patients. In addition, indications have expanded to include disorders such as painful diabetic neuropathy and chronic pain disorders such as complex regional pain syndrome (CRPS).[3] Moreover, dorsal root ganglion stimulation (DRG-S) has recently been used for CRPS and neuropathic pain conditions.

In addition to SCS and DRG-S, peripheral nerve stimulation (PNS) has emerged as an effective intervention for isolated neuropathic conditions for individuals who may not be candidates for neuraxial neurostimulation. For example, patients may have had previous surgery making access to the epidural space difficult, have complex spinal anatomy, or have specific mononeuropathies not amenable to treatment with neuraxial neuromodulation.[4–6] Furthermore, some patients may prefer temporary PNS systems to permanent neuraxial devices. With the rapid growth in commercially available percutaneous PNS systems, neuromodulation can now be considered in a larger cohort of patients.

Although SCS, DRG-S, and PNS have been shown to be effective, failed neuromodulation is costly and problematic for many reasons. Unfortunately, patients' expectations for pain relief may not be met over time, and they may eventually opt to have the device removed. The disappointment of failed treatment and the subsequent explantation of the device have an emotional impact on the patient and are associated with additional financial costs. Han et al evaluated differences in health care utilization between patients who underwent explant up to three years after an SCS trial and those who did not undergo explant. The explant cohort was found to have 2.65 times greater total cost than that of patients who were not explanted, and underwent more procedures three years after the SCS implant.[7] Other data have revealed patient-related factors such as uncontrolled psychiatric disease and high-dose opioids leading to poor candidacy for neuromodulation technique.[8,9] Careful selection is thus imperative in terms of patient beneficence, patient outcomes, and resource utilization. To this end, the Neuromodulation Committees at University of California Davis (UCD) and Stanford University were created to identify these risk factors and enact a collaborative and interdisciplinary approach to candidate selection for neuromodulation (Fig. 1).

The literature is scarce when describing such an interdisciplinary committee, so our process is described later. Another objective of this report is to conduct an observational retrospective cohort study to determine the factors considered and the outcomes arising from optimal patient selection using an interdisciplinary neuromodulation committee.

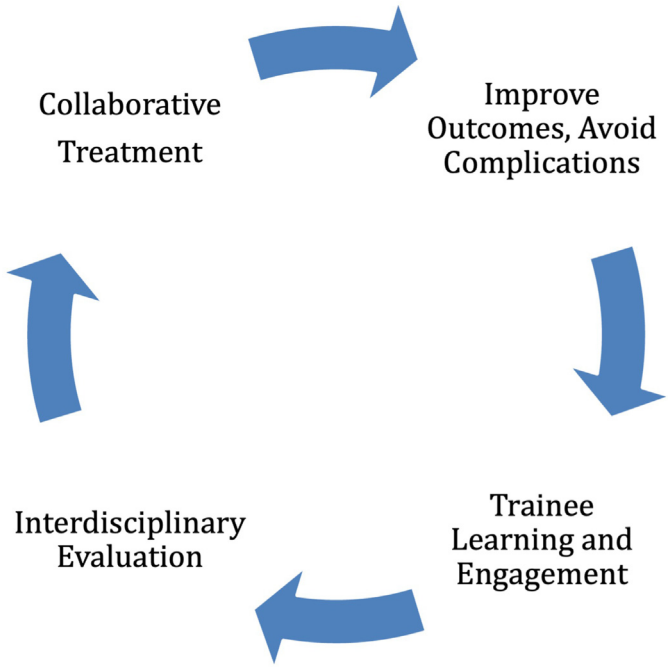

Figure 1. Goals of the Neuromodulation Committee. Interdisciplinary engagement and trainee involvement are critical components. [Color figure can be viewed at www.neuromodulationjournal.org]

Neuromodulation Committee Review Process

The first step in the screening process is performed by the patient's medical team, which includes an attending pain physician and a fellow. Patients whose pain targets may respond to neuromodulation are encouraged to have their case discussed at the interdisciplinary committee. Once neuromodulation is determined to be a possible course of treatment, the care pathway, treatment expectations, risks, and benefits are explained to the patient in detail, including the rationale for preprocedural psychologic screening. In our institutions, the threshold for review by the Neuromodulation Committee is low (eg, candidates are reviewed by the committee if there is a consideration of neuromodulation, even among other therapeutic options), and this enables maximum access for patients in our interdisciplinary process. After the visit and in preparation for the committee meeting, the medical team for each patient reviews and summarizes each patient's medical treatment history. This review includes the use of medications such as opioids, gabapentinoids, nonsteroidal antiinflammatory drugs, acetaminophen, tricyclic antidepressants, and serotonin-norepinephrine reuptake inhibitors. Specific attention is given to the patient's opioid regimen. An oral morphine equivalent (OME) is calculated because a high OME may predict poor outcomes of neuromodulation, such as an increased risk of explant.[9] In addition, previous interventional therapies for pain, previous surgeries, current anticoagulation status, and relevant medical and psychologic history are noted. Standard laboratory workup also is obtained in preparation for the Neuromodulation Committee meeting and may include a complete blood count, coagulation panel, and hemoglobin A1c. In certain situations, additional lab tests might be requested based on patient factors like past kidney or liver issues and previous infections such as methicillin-resistant staphylococcus aureus (MRSA). Additional imaging also may be obtained, including magnetic resonance imaging (MRI) or computed tomography (CT), depending on the intended location of the neuromodulation device.

Precommittee Psychologic Evaluation

After an initial screening and recommendation for the Neuromodulation Committee, patients are typically required by insurance payers to meet with the pain psychologist to evaluate their readiness and treatment optimization for neuromodulation from a psychologic standpoint. The evaluation is comprised of an in-person or virtual interview with the patient and completion of a self-report assessment. The clinical interview explores the psychologic variables that are known to affect pain, mood, function,

and treatment outcomes, including (but not limited to) adverse childhood experiences, psychiatric functioning, substance use and abuse, active stressors, current and past global functioning (eg, physical activity, work, and leisure activities), pain interference, and relationships and support systems. Critical to the neuromodulation evaluation are additional questions related to the patient's understanding of the procedure and its associated risks, treatment expectations, ability to cope with neutral or adverse outcomes, and compliance history. The self-report psychologic assessment devices can provide additional specific data to facilitate formulating a more comprehensive perspective on the patient's candidacy for such treatment pathways. Upon completion of the evaluation, a comprehensive written report is generated that integrates the findings from the self-report assessments and the interview. In the impressions and recommendations, the psychologist will identify potential risk factors affecting neuromodulation outcomes and recommend interventions to address them. The report highlights the potential success and possible contraindications to the entire committee, alongside recommended treatment pathways to optimize treatment outcomes. Using this information, the pain physician ultimately decides whether neuromodulation is appropriate for their patient.

Neuromodulation Committee Case Presentation

During the Neuromodulation Committee meeting, a summary of the patient's history and physical examination is presented, along with studies such as current laboratory test results, imaging (ie, MRI or CT), and electromyographic and nerve conduction studies. There is no specific hemoglobin A1c (HbA1c) cutoff, but rather, there is an expectation that patients have made progress with their diabetes control as a proxy for overall treatment compliance. What is considered an acceptable HbA1c level varies, and a recent review found that this measure alone does not necessarily estimate the risk for perioperative infection.[10] In contrast, tobacco cessation is required to decrease the risk of wound infection and adverse outcomes.[11,12] At both institutions, patients must be tobacco free for at least eight weeks before moving forward with any neuromodulation therapy. MRSA status also is reviewed for presurgical antibiotic planning.

Regarding imaging, the committee typically recommends that lumbar and thoracic MRI or CT imaging be obtained if dorsal column thoracic leads are placed. This guidance follows the Neuromodulation Appropriateness Consensus Committee guidelines for the prevention of neurologic injury, which state that advanced neuraxial imaging should be performed in the location of needle placement and the location of ultimate lead placement.[13] This is a critical step to determine whether the patient may not be a candidate for percutaneous leads and may subsequently require the surgically placed paddle leads. If a high-grade obstruction is seen on advanced imaging (eg, stenosis of the central canal for SCS or foraminal stenosis for DRG-S), the procedure may not be feasible.

It is not uncommon for patients to be taking anticoagulant or antiplatelet medications. In such cases, a risk-benefit discussion is held regarding the discontinuation of these agents to proceed with neuromodulation, usually with the prescribing medical clinician. The American Society of Regional Anesthesia and Pain Medicine has classified SCS and DRG-S as high-risk procedures. PNS is classified as a low-to-intermediate risk procedure.[14] As such, the implanter must explain the procedure's risks to patients, including bleeding, infection, and possible damage to nerve structures. In most cases for PNS, anticoagulation is continued, in contrast to SCS and DRG-S procedures. However, some patients may be unable to hold their anticoagulation safely for neuraxial cases, so neuraxial neuromodulation must be postponed.

The proposed neuromodulation device, lead placement, and on/off label uses also are discussed. The type of waveform, device manufacturer, and pulse generator type that is optimal for the patient on the basis of presenting symptoms is discussed. The appropriate location for the implant is selected depending on the patient's pain location, and an appropriate operating room case time is selected along with required operative imaging (eg, fluoroscopy for SCS or ultrasound for PNS).

Lastly, the pain psychologist discusses psychosocial risk factors that may affect outcomes, in addition to recommended concurrent or prerequisite interventions to address these issues. This may include (but is not limited to) referral to a psychiatrist or psychologist for treatment of comorbid conditions. Patients are then given a tentative advisory green, yellow, or red color designation after committee review indicating no issues with proceeding, proceeding with caution, or recommending not proceeding, respectively. A discussion also is held regarding which treatment options would be presented to the patient if neuromodulation fails. This may include offering alternative neuromodulation devices, behavioral interventions, pharmacologic treatment, or a combination thereof. The committee's recommendations are documented in the patient's electronic medical record (Table 1). This information is then relayed to the patient by direct communication with their treating physician; next, a shared physician-patient decision is made regarding neuromodulation based on the committee's recommendations.

MATERIALS AND METHODS

Institutional review board approval at both institutions was obtained for this retrospective study. The inclusion criteria were adult patients (aged ≥18 years) who underwent evaluation by the UCD and Stanford Neuromodulation Committees. The COVID-19 global pandemic altered clinical practices and workflow, so this pre–COVID-19 time frame was chosen for analysis.

A retrospective chart review was completed in 77 patients evaluated at UCD from May 2019 to April 2020. Earlier data were not available because the committee was started in 2019. A total of 308 patients from Stanford were reviewed from January 2017 to April 2020. These data correspond to the period before the COVID-19 pandemic and subsequent procedure shutdowns that affected committee throughput for more than a year. Data collected from the chart review included demographics (eg, age, sex), committee meeting results (defined as proceeding with a trial, proceeding with caution, or not proceeding), implant device, and date. The chart review also noted the reasons for not recommending a neuromodulation device. The percentage of patients who underwent successful neuromodulation trials and subsequent implants also was noted. The percentage of patients having a successful spinal neuromodulation trial, an established outcome in the literature, served as a measure in this review for appropriate patient selection by the committee. Notably, this same measurement was not used for PNS given there is no trial procedure.

The composition of the Neuromodulation Committee at each institution follows an interdisciplinary format. UCD has four

Table 1. Sample Postcommittee Template Used by the Neuromodulation Committee at UCD for Each Patient Presented at the Conference.

Action plan based on the committee's recommendations:

Recommendations:

1. Move forward with neuromodulation trial/implant? Y / N
2. Recommended device: SCS/DRG-S/ PNS device
3. Recommended lead targets; Spinal level or peripheral nerve target(s):
4. Can an MRI be performed with the recommended device? Y / N
5. Is additional imaging needed? Y / N; if yes, list study needed
6. Are additional labs needed? Y / N; if yes, list study needed
7. Is an anticoagulation plan needed: Y / N; if yes, list physician to contact
8. Is an antibiotic plan needed? Y / N; this would include non-standard antibiotics or postoperative courses
9. Psychologic recommendations: List any red or yellow flags
10. What is the plan if the neuromodulation trial/implant fails?

FOR CASE SCHEDULING:

1. Proposed time for the case?
2. Location of case?
3. Imaging for the case? Fluoroscopy vs ultrasound vs both
4. Rep needed for the case? Y / N; if yes, state company
5. Other day of surgery needs:

N, no; Rep, representative; Y, yes.

experienced neuromodulators who implant SCS, DRG-S, and PNS devices. The committee comprises these implanters, a pain psychologist who completes all preprocedural psychologist assessments, other pain physicians who do not implant but whose patients are being discussed by the committee, a case scheduler, and current pain fellows and other trainees. The fellows are primarily responsible for case presentation and discussion, and the committee meets bimonthly for one hour. Stanford University has five experienced neuromodulators, a team of three full-time pain psychologists, a neuromodulation nurse practitioner, other pain physicians who do not implant but whose patients are being discussed by the committee, pain medicine fellows and other trainees, and pain psychology fellows. The senior author of the paper (Vafi Salmasi) is responsible for presenting all cases at Stanford because the committee meets once or twice per month for one hour on the basis of patient volume.

The committee aims to weigh the risks and benefits of the chosen neuromodulation device, procedural approach, and patient candidacy. The cases are presented in conjunction with the pain psychologist's input to inform the implanters regarding the patient's psychologic readiness and appropriateness for neuromodulation, and consensus recommendations are obtained before pursuing the neuromodulation trial or implant or choosing to defer on the basis of shared decision-making with the patient. This committee review is a mandatory step for progression to neuromodulation trial and implant at both institutions, although the committee recommendations are considered advisory and not definitive.

RESULTS

Demographics

The committees presented and discussed 385 patients in the team conference sessions from 2017 to 2020. The cohort included 54% female and 46% male patients with a mean age of 56 years (ages ranging from 18–92).

NEUROMODULATION COMMITTEE REVIEW DATA

Of the 385 screened patients, the committees recommended an implantable device (neuraxial or peripheral) in 337 patients (87.5%). Continuation of conservative therapy was deemed a more appropriate treatment path for the remaining 48 patients (12.5%) (eg, "do not proceed") (Table 2).

In the 48 patients deemed not suitable for neuromodulation, psychologic factors were the main barrier to proceeding with advanced interventions in 23 patients (47.9%). These patients presented with untreated or poorly controlled psychiatric disorders (mood disorder in 16 patients, posttraumatic stress disorder in four patients, and substance use disorder in three patients). Our teams recommended formal mental health or substance use treatment followed by reevaluation with our pain psychologists. The remaining patients in this group had a variety of other medical factors that precluded their candidacy. For 13 patients (27.1%), our teams decided that implantable devices would not be the best medical option because of the pain type (eg, mechanical pain from fracture, whole body pain) or significant other comorbidities. Our team recommended bariatric surgery consultation for weight loss for two patients (4.1%). Five patients (10.4%) had significant noncompliance or aggressive behavior in the past (Fig. 2). In the latter cases, our recommendations focused on more longitudinal conservative care and behavioral agreements to improve compliance and cooperation with the clinical team before reconsidering implantable devices. Three patients (6.3%) had significant cognitive impairment and did not have enough support at home to apprehend and maintain neuromodulation therapy; we recommended continuing multidisciplinary conservative treatment for these individuals. In four patients (8.3%), there was complex anatomy, including spinal instrumentation (that obliterated epidural space) or significant spinal canal stenosis at the target level of lead placement; we referred these patients for neurosurgical evaluation.

Trial and Implantation

Of 278 patients recommended for SCS or DRG-S, 131 underwent trials with percutaneous leads (47.1%). Trials were successful (ie, causing a ≥50% reduction in self-reported pain or improved function) in 108 patients (82.4%). The remaining patients either declined neuromodulation therapy, are going through optimization processes (eg, evaluation by cardiology, smoking cessation, behavioral health, or psychiatry) before the procedure, transferred care to another clinic, are awaiting procedure dates, chose not to proceed, or were lost to follow-up. The institutions completed 87 permanent implant procedures of the 131 DRG-S/SCS trials. This represents a trial-to-permanent ratio of 66.4% (Table 2). The implant procedure was aborted in three patients because of technical problems or the patient's inability to tolerate anesthetic sedation for the case.

Of 59 patients recommended to receive PNS, 28 patients (47.4%) proceeded with implanting PNS devices (temporary and permanent systems). No formal trial was completed for PNS implants, but most patients received a diagnostic nerve block before implantation of the PNS device.

Table 2. Summary of Committee Date.

Patients presented at committee	385
Recommended for neuromodulation	337 (337/385 = 87.5% of patients presented in committee)
Recommended for DRG-S/SCS	278 (278/337 = 82.5% of patients recommended for neuromodulation)
Recommended for PNS	59 (59/337 = 17.5% of patients recommended for neuromodulation)
Declined for neuromodulation	48 (48/385; 12.5% of patients presented in committee)
Patients who underwent DRG-S/SCS trial	131 (131/278; 47.1% of patients recommended for neuraxial neuromodulation)
Successful trial	108 (108/131; 82.4% of patients trialed)
Permanent implant	87 (87/131; 66.4% of patients trialed)

DISCUSSION

This study reports what we believe is the first use of a clinical committee to systematically analyze the components of neuromodulation candidacy that might offer improved patient outcomes. Our novel collaborative mechanism brings interdisciplinary teams together to discuss how to 1) best select patients for a neuromodulation technique, 2) optimize them both medically and psychologically, and 3) offer them the best choice of therapy. The educational component of such a committee in a medical center with pain fellowship training programs is a critical benefit. Bringing together multiple pain specialists, behavioral health experts, and fellow trainees is collaborative and educational, and best serves the patients by offering broad perspectives. However, psychologic review and interdisciplinary committee discussion is a resource-intensive endeavor, and we recognize that this type of clinical committee review before each neuromodulation trial may not be feasible in all settings.

Most insurance companies mandate psychologic evaluations before SCS and DRG-S and increasingly before PNS. Uncontrolled mood disorders, including depression and anxiety, have been associated with increased complications, reoperation, and readmission rates after SCS.[8] A limited understanding of the critical nature of psychologic comorbidities often leads to a misperception by the patient that the evaluation is a routine step in a predetermined path to neuromodulation rather than a critical step that can help influence outcomes. At other times, the psychologic evaluation may erroneously be perceived as a barrier to care. A systematic literature review found that psychologic factors were stronger predictors of poor treatment outcomes with lumbar surgery and SCS than were pretreatment physical findings, activity interference, and presurgical pain intensity.[15] These findings help explain why a neuromodulation implantation procedure may be technically proficient with no complications yet produce poor functional outcomes; patient variables that are not apparent in most routine medical visits may play a critical role. Comprehensive presurgical psychologic evaluations routinely assess for such variables and thus should be perceived as an adjunct therapy that can improve outcomes with neuromodulation.

Although most patients were recommended for neuromodulation, a significant proportion (12.5%) were not immediately deemed appropriate candidates. As mentioned previously, in our institutions, the threshold for review by the Neuromodulation Committee is low, to enable maximum access for patients in our interdisciplinary process. Within both practices, there are pain physicians who do not perform neuromodulation but will refer patients to the committee. Therefore, it serves as a forum for discussion, especially around indications and potential approaches for each patient. In addition, the interdisciplinary nature of our patient review can elucidate concerning patient factors that are better defined after committee review. A secondary benefit is a committee review of all possible candidates who represent excellent cases for fellow education (eg, learning reasons not to proceed with neuromodulation may be just as important as reasons to proceed). The reasons for not proceeding with neuromodulation include psychologic or psychiatric for almost half of the patients (47.9%) deemed inappropriate candidates. This served as an opportunity to offer further services to patients needing more support. In addition, fewer than half of the patients who were cleared by the Committee underwent subsequent neuraxial device trials (47.1% of patients recommended). This also represented an opportunity for closer follow-up, engagement, and education for those who did not proceed with a neuromodulation trial. Some proposed reasons for this attrition include a lack of understanding about the procedure, concern over benefits vs risks, challenges with insurance coverage (particularly for PNS), lack of follow-up, and decision to seek alternative therapies. These data suggest a need for close monitoring and follow-up for implant candidates. Implementing an organized process that efficiently moves patients through the various stages of the neuromodulation process may help retain patients and improve the number of patients who progress to trial and/or permanent implant. More study is needed to determine best practices, optimize patient flow, and understand the factors that improve patient outcomes.

Notably, our rigorous patient selection and optimization process produced a high trial success rate, an established outcome measure that may indicate the effectiveness of our committee in patient selection. In our academic centers, 82.4% of patients had a successful trial. These are higher success rates than those in reports from other academic centers and large retrospective data base reviews, which we believe are attributable to more rigorous patient selection and optimization.[16,17] For example, a multicenter review in 244 patients at two institutions (Hopkins Medical Institutions and Walter Reed Army Medical Center) showed a successful trial rate of 67.2%.[17] For patients who ultimately went on to have permanent implantation of DRG-S or SCS devices, this study reported a trial-to-permanent ratio of 66.4%. This ratio is comparable to other analyses looking at trial-to-permanent ratios and suggests interdisciplinary evaluation can be an important component of neuromodulation success. The importance of an optimization mechanism to improve the success rate of neuromodulation trials, manage patient expectations, and decrease complication rates is crucial for the future landscape and viability of neuromodulation for patients with chronic pain. There is increasing pressure from third-party payers to show appropriate allocation of interventions for patients, considering the increasing cost of health care and more

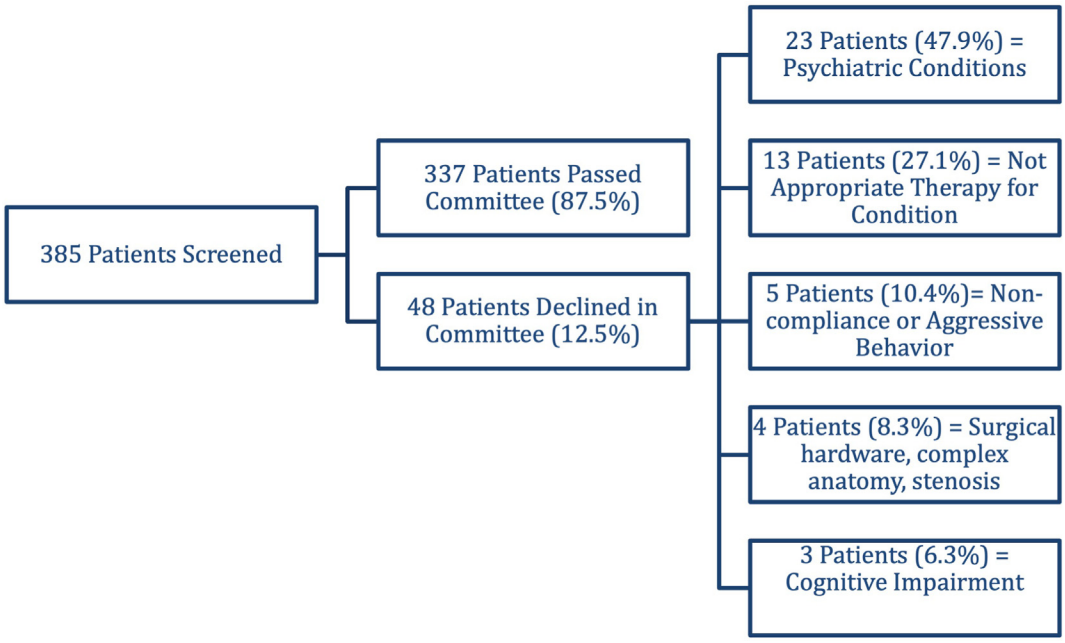

Figure 2. Reasons patients were not recommended for neuromodulation therapy. Psychiatric issues remain the most prevalent, but a variety of other challenges exist. [Color figure can be viewed at www.neuromodulationjournal.org]

advanced interventions; SCS trials can cost >$10,000.[18] A novel approach such as ours offers substantial positive implications for patients regarding clinical care and cost savings, with few downsides and limited investment.

In this study, we present an initial report of a novel comprehensive process implemented in two institutions to enhance neuromodulation outcomes by improving patient selection and optimization. Limitations include generalizability. Our goal is to identify the key factors to predict success for neuromodulation in our academic centers and provide recommendations that can be implementeed in most practice settings. Although we believe that this process is a valuable addition to both clinical care and trainee education in academic medical centers, it might not be feasible to implement in smaller practices owing to the resources needed. Another limitation of our report is the lack of long-term outcome data such as multiyear outcomes (eg, explant rate, pain scores, opioid use, etc). These long-term outcomes are the focus of future studies for our institutions, and the intention of this report is to describe a novel interdisciplinary model and highlight its potential benefits.

CONCLUSIONS

This study highlights the collaborative workflow process involving a clinical committee comprising pain physicians and pain psychologists in the context of neuromodulation trials. The findings indicate that such an approach can lead to positive success rates in neurostimulator trials, particularly at academic centers, by combining the expertise of both medical and psychologic professionals. In addition, this collaborative committee facilitates an excellent educational opportunity for pain medicine trainees completing an Accreditation Council for Graduate Medical Education-accredited fellowship. It offers the trainees a framework for choosing a neuromodulation device for certain patients and an understanding of a medical-psychologic risk-benefit discussion. Lastly, the trainees can interact with behavioral health specialists to see patients' options for psychologic optimization.

In conclusion, our study underscores the potential benefits of a collaborative committee review process involving pain physicians and psychologists in improving neuromodulation success rates.

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Authorship Statements

Scott G. Pritzlaff, Michael Jung, Juliann Cho, and Vafi Salmasi designed and conducted the study, including record review, data collection, and data interpretation. Vafi Salmasi had complete access to the study data and completed all statistical analyses. Michael S. Leong and Ravi Prasad offered editorial support during the preparation of this manuscript. All authors approved the final version of the manuscript.

Conflict of Interest

Scott G. Pritzlaff has had a financial agreement or affiliation with the following commercial interests in the form of consultant: Bioness, SPR Therapeutics, Nalu Medical, EBT Medical; royalties: Oxford University Press, Wolters Kluwer; and research grants; Medtronic, Nevro Corp, and Abbott. Michael Jung, Naileshni Singh, Juliann Cho, Matthew Skoblar, and Manoj Jagtiani reported no conflicts of interest. Michael S. Leong has had a financial agreement or affiliation with

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SUPPLEMENTARY DATA

To access the supplementary material accompanying this article, visit the online version of *Neuromodulation: Technology at the Neural Interface* at www.neuromodulationjournal.org and at https://doi.org/10.1016/j.neurom.2023.12.003.

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COMMENTS

This is largely a descriptive study showing care paths at two major academic centers. It is important to note that success in this setting is defined as moving to an implant and does not indicate long-term outcomes. In addition, it appears as if nonimplanting physicians or physicians early in their training can refer to the center for evaluation to proceed for additional advice and training. This strategy may help decrease long-term failures, but this will need to be followed up in a different trial design. Although the authors have presented an interesting approach to care, it is not clear that this is transferable to high-volume private practices. Many private practice centers could not afford to offer this comprehensive evaluation with inherent layered costs.

Peter Staats, MD, MBA
Frederick, MD, USA

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This article highlights the benefits of the multidisciplinary approach to enhancing patient selection in neuromodulatory therapies. Ideally, this will improve overall outcomes longitudinally.

Alexios Carayannopoulos, DO, MPH
Providence, RI, USA