CASE REPORT

Medical Journal of Western Black Sea
Batı Karadeniz Tıp Dergisi

Med J West Black Sea 2025;9(3):472-475
DOI: 10.29058/mjwbs.1799774

"The elephant is gone": Spinal cord stimulation for therapy-refractory angina pectoris: A case report

"Fil gitti": Tedaviye dirençli angina pektoris için omurilik stimülasyonu: Bir olgu sunumu

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Cite this article as: *Gunduz ME et al. "The elephant is gone": spinal cord stimulation for therapy-refractory angina pectoris: a case report. Med J West Black Sea. 2025;9(3):472-475.*

ABSTRACT

Refractory angina pectoris (RAP) represents the group that continues to experience recurrent angina attacks despite optimal treatment, lifestyle modifications, and implemented revascularization options. This condition, called RAP, results in significant deterioration in quality of life and a high healthcare burden. Previous studies have reported that spinal cord stimulation (SCS) therapy provides significant improvement in symptoms in patients with RAP, reduces the frequency of angina attacks, reduces the need for antianginal medication, and improves quality of life. Our case demonstrates the potential benefit of spinal cord stimulation in carefully selected patients with refractory RAP. After treatment, our patient achieved sustained symptomatic relief, functional gains, and reduced nitrate dependence. This case provides a good example of an innovative and promising treatment approach for patients with RAP, whose options are limited due to the inadequacy or inapplicability of conventional treatment methods. In the future, cardiologists' adoption of SCS as a component of their treatment strategies and their application of this approach in a multidisciplinary framework together with neurosurgeons and interventional pain specialists will be a decisive factor in SCS gaining a strong place in RAP treatment guidelines.

Keywords: Angina pectoris, neuromodulation, refractory angina pectoris, spinal cord stimulation

ÖZ

Refrakter anjina pektoris (RAP) optimal tedavi, yaşam tarzı değişikliği ve uygulanmış revaskülarizasyon seçeneklerine rağmen tekrarlayan anjina atakları yaşamaya devam eden grubu temsil etmektedir. Bu duruma RAP denilmekte ve yaşam kalitesinde ciddi bozulma ve yüksek sağlık hizmeti yüküne neden olmakla sonuçlanmaktadır. Daha önce yapılan çalışmalar, omurilik stimülasyonu (SCS) tedavisinin RAP tanılı hastaların semptomlarında belirgin düzelme sağladığını, anjina ataklarının sıklığını düşürdüğünü, antianjinal ilaç kullanım gereksinimini azalttığını ve hastaların yaşam kalitesini artırdığını bildirmektedir. Vakamız, dirençli RAP tanılı iyi seçilmiş hastalarda omurilik stimülasyonunun potansiyel faydasını göstermektedir. Hastamız, tedavi sonrası kalıcı semptomatik rahatlama, işlevsel kazanımlar elde etmiş ve nitratlara olan bağımlılığı azaltmıştır. Bu vakamız, klasik tedavi yöntemlerinin yetersiz olması veya uygulanabilir olmaması nedeniyle sınırlı seçeneklere sahip olan RAP tanılı hastalar için yenilikçi ve umut verici bir tedavi yaklaşımına güzel bir örnek olmaktadır. Gelecekte kardiyologların SCS'yi tedavi stratejilerinin bir bileşeni olarak benimsemesi ve bu yaklaşımı beyin cerrahları ile girişimsel ağrı uzmanlarıyla birlikte multidisipliner bir çerçevede uygulamaları, SCS'nin RAP tedavi kılavuzlarında güçlüce yer bulmasında belirleyici bir etken olacaktır.

Anahtar Kelimeler: Angina pektoris, nöromodülasyon, omurilik stimülasyonu, refrakter angina pektoris,

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Highlights

- Refractory angina pectoris (RAP) is defined as recurrent angina despite optimal treatment and exhausted revascularization, leading to significant quality of life deterioration and a high healthcare burden.
- Our case study demonstrates the potential benefit of Spinal Cord Stimulation (SCS) in well-selected RAP patients, showing sustained symptomatic relief, functional improvement, and reduced nitrate dependence.
- The future successful integration of SCS into RAP guidelines depends crucially on its multidisciplinary adoption by cardiologists, neurosurgeons, and interventional pain specialists.

INTRODUCTION

Ischemic heart disease (IHD), a subgroup of cardiovascular diseases (CVDs) often used interchangeably with coronary artery disease (CAD)—is the single most common cause of death globally, accounting for more than 9 million deaths annually (1). Clinically, CAD often manifests as angina pectoris (AP), which is a symptom of myocardial ischemia rather than a disease itself. Patients classically present with retrosternal pressure or squeezing, sometimes radiating to the left arm, neck, back, or upper abdomen; episodes are often provoked by exertion, cold, or emotional stress, and typically relieved by nitroglycerin (2,3).

Angina is categorized as stable or unstable. The term acute coronary syndrome (ACS) includes unstable angina and myocardial infarction. Unstable angina, sometimes called a preinfarction syndrome, carries a short-term risk (~ 20 %) of evolution into infarction (4,5). A subset of patients continues to experience recurrent angina attacks despite optimal therapy, lifestyle modification, and exhausted revascularization options. This entity is termed refractory angina pectoris (RAP) (6). RAP causes profound impairment in quality of life and high health care burden (7).

Diagnostic criteria typically include (8):

1. Evidence of reversible myocardial ischemia in the presence of significant CAD
2. Symptoms consistent with NYHA / CCS III–IV
3. Failure to respond to maximal pharmacologic therapy
4. Absence of further percutaneous or surgical revascularization options
5. Exclusion of non-cardiac chest pain

Spinal cord stimulation (SCS) is a neuromodulatory technique that delivers low-voltage electrical impulses to the dorsal columns of the spinal cord via epidurally placed leads connected to an implantable pulse generator (IPG). These impulses modulate nociceptive and autonomic pathways, thereby reducing the perception of ischemic pain and improving myocardial blood flow. Previous research has shown that spinal cord stimulation (SCS) provides significant improvement in symptoms, reduces the number of angina attacks, reduces the need for anti-anginal medication, and contributes positively to patients' quality of life (9,10).

Implantation technique: In refractory angina, the SCS lead is typically inserted a minimally invasive percutaneous approach into the epidural space and advanced under fluoroscopic control toward C7–T1 (11). Positioning slightly paramedian to the side of maximal pain (usually left) is recommended to optimize coverage. The patient remain awaked for paresthesia mapping. After a trial stimulation period (usually 5–14 days) demonstrating ≥ 50 % symptom reduction or nitrate sparing, a permanent implantable pulse generator is placed subcutaneously (commonly in the gluteal or abdominal region) under sterile conditions.

Meta-analyses of randomized controlled trials (RCTs) show that spinal cord stimulation (SCS) significantly reduces angina frequency (~ –9 attacks/week) and nitroglycerin use (~ –0.6 doses/week) compared with controls (12). Long-term observational follow-up studies report sustained improvements in symptoms and quality-of-life over years (13,14).

Despite the evidence, SCS remains underutilized in the management of RAP. Barriers include limited awareness in cardiology, absence of referral networks, and uncertainty in patient selection (15).

CASE

A 70-year-old male patient with therapy-refractory stable angina pectoris (ICD-10 I20.8) and thoracic back pain was evaluated for neuromodulation. The medications used by the patient were as follows; Nitroglycerin 0.4 mg/d, Allopurinol 150 mg/d, Ezetimibe/Atorvastatin 10/40 mg/d, Molsidomine 8 mg/d, Esomeprazole 80 mg/d, Famotidine 80 mg/d, Dapagliflozin 10 mg/d, Isosorbide dinitrate 40 mg/d, Nebivolol 2.5 mg/d, Ranolazine 1000 mg/d, Torasemide 10 mg/d, Valsartan 80 mg/d, Apixaban 10 mg/d. His history included two-vessel CAD, biological aortic valve replacement in 2017, and ten prior coronary angiographies and interventions.

The latest angiography showed patent coronaries with no new stenoses. However, he continued to suffer ~4 nitrate-responsive angina attacks/week, described as pressing or burning pain, peaking at 7/10 (average 5–6/10) on

the NRS. Each lasted hours during which he had to cease activity. Triggers included stress and cold weather.

He is the owner and head of a private school, still professionally active. Given exhaustion of conventional therapies and persistent nitrate-responsive angina, an SCS trial was indicated due to therapy-refractory angina despite maximal optimized medical therapy.

Trial phase: In October 2023, an epidural lead (C7-Th2) was placed under fluoroscopy (Figure 1). After confirming paresthetic coverage in tonic mode, burst mode stimulation was initiated. After activation of the device, the patient immediately reported that the sensation of "an elephant on the chest" was gone, indicating prompt relief of the ischemic pain component. During the trial phase after implantation of the lead, no angina episodes occurred, and the patient required no nitroglycerin. Mild procedural discomfort was managed with short-term intravenous analgesia.

When stimulation was turned off temporarily, angina recurred at 5–6 attacks/week with baseline characteristics. The patient described the trial period as life-changing and requested permanent implantation.

Permanent Implantation & Follow-Up: In November 2023, a permanent SCS system was implanted. Over 2 years of follow-up, the patient demonstrated:

- Improvement in CCS class: from III → I-II
- Nitroglycerin use: from ~4/week → ~1/month
- Marked improvement in quality of life and functional capacity

No device-related complications were noted (e.g. lead-migration, infection).

DISCUSSION

This case illustrates the potential benefit of spinal cord stimulation in well-selected patients with refractory angina pectoris. The patient obtained durable symptomatic relief, functional gains, and reduced reliance on nitrates.

In recent decades, neuromodulation has increasingly entered clinical practice through a variety of invasive and noninvasive approaches. Many of these treatments have demonstrated not only that their adoption improves quality of life but also that a multidisciplinary approach is key to successful implementation. Invasive procedures such as deep brain stimulation, dorsal root ganglion stimulation, peripheral nerve stimulation, peripheral subcutaneous field stimulation, and vagus nerve stimulation are available, as are noninvasive methods such as functional electrical stimulation, transcranial magnetic stimulation, and transcutaneous electrical nerve stimulation (7). Since its first reports in the 1980s, SCS the popular neuromodulation method has been validated as an effective, safe, and cost-efficient therapy in RAP (12,13,16,17). Meta-analysis of RCTs confirms reductions in angina episodes and nitroglycerin consumption, with concurrent improvements in exercise tolerance and quality-of-life (9,18). Long-term registries demonstrate sustained benefit and low explantation rates (13,14).

Concerns that SCS might mask ischemia or infarction are not supported: ambulatory ECG / ST monitoring studies have not shown increased silent ischemia during SCS (18,19). Mortality in RAP patients treated with SCS is commensurate with expectations in similarly ill populations (13).

Despite this evidence, SCS remains underused. A major barrier is the lack of integration between cardiology and neuromodulation services (15). Increased cross-disciplinary education, referral pathways, and guideline inclusion are needed to expand access.

As newer stimulation paradigms such as high-density, paresthesia-free modes evolve, future research should aim to refine stimulation protocols, patient selection, and long-term outcomes

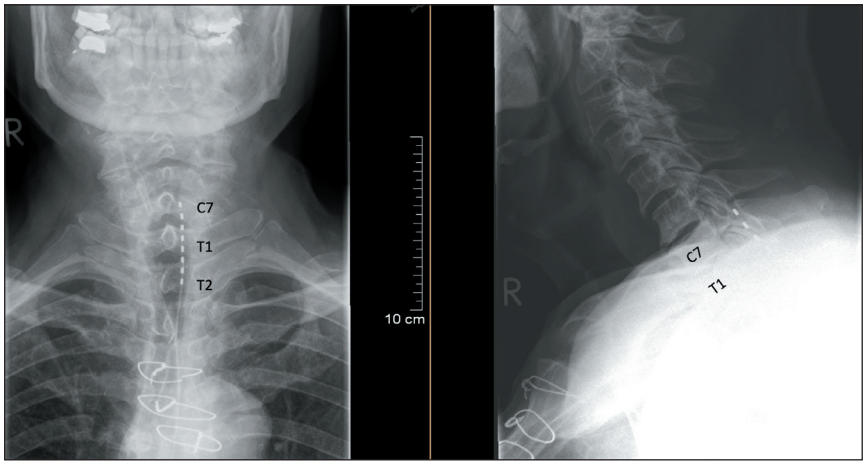

Figure 1: Fluoroscopic view showing the placement of the epidural electrode within the C7–Th2 epidural space.

Author Contributions

Study conception and design: **Muhammet Enes Gunduz, Erkan Ozduran, Volkan Hanci;** data collection: **Muhammet Enes Gunduz, Erkan Ozduran;** analysis and interpretation of results: **Muhammet Enes Gunduz, Erkan Ozduran, Volkan Hanci;** draft manuscript preparation: **Muhammet Enes Gunduz, Erkan Ozduran, Volkan Hanci.** The author(s) reviewed the results and approved the final version of the article.

Conflicts of Interest

The authors have no conflict of interest to declare.

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