One Pulse at a Time: Exploring Spinal Cord Stimulator Anatomy to Enhance M1 Medical Education

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Introduction

The integration of anatomical science with clinical practice is essential in medical education. Spinal Cord Stimulator (SCS) is a device that sends electric impulses to the spinal cord as a form of chronic pain management. SCS is utilized when other non-surgical forms of pain management are ineffective.[1] It is considered more effective than medical treatment for a 50% and greater pain reduction in patients with intractable limb pain, Failed Back Surgery Syndrome, and various chronic pain disorders including peripheral neuropathies, chronic back pain and diabetic neuropathy.[2]

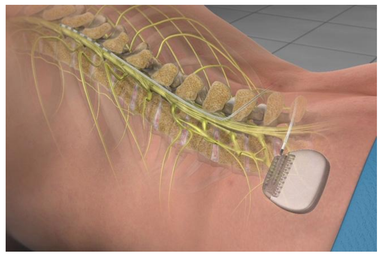


Figure 1. Illustration of Spinal Cord Stimulation (SCS) and electrode placement along the vertebral column

Objectives

To utilize dissection to educate medical students regarding surgical chronic pain management and other clinical applications of SCS devices.

Methods

1. DISSECTION

Routine cadaveric dissections were performed by students on 23 donors (11 female, 12 male).

2. SCS DISCOVERY

A subcutaneous implantable pulse generator was identified at the left iliac crest of one male donor.

3. LAMINECTOMY

A laminectomy was performed, and electrodes were traced from the pulse generator at L4 - T3 within the vertebral canal.

4. DOCUMENTATION

The anatomical findings were documented through video and photos, alongside the pod students' reflections.

Results

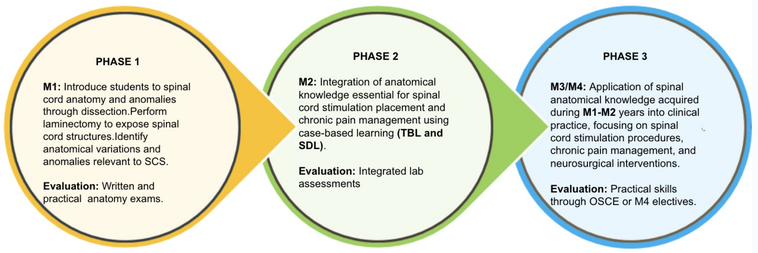
The SCS device was observed in only 1 out of 105 total donors dissected over five years at OUWB.

Figure 2. A laminectomy revealed two electrodes originating from the implantable pulse generator at the L3 level, traveling superiorly within the epidural space and terminating at the T8 level.

Figure 3. The SCS system includes an implantable pulse generator (Precision Plus by Boston Scientific), a handheld remote control, and an external charger. This specific device was identified during the laminectomy.[4]

Conclusions

This discovery provided a rare opportunity to explore the clinical utility of SCS in surgical pain management in the early stages of students' medical careers. Future directions include a mixed methods survey to gauge the educational impact of this finding on shaping well-rounded physicians, along with integration of SCS into medical curriculum.



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Discussion

- Spinal Cord Stimulator (SCS) identified in the lab served as a valuable learning opportunity to bridge anatomical knowledge with clinical applications in interventional pain management. Integrating these findings into the medical curriculum can enhance students' understanding of spinal cord anatomy, procedural techniques, and the role of neuromodulation in chronic pain management.

- SCS technology is a rapidly evolving non-pharmacological treatment for chronic pain, initially developed based on Wall and Melzack's Gate Control Theory of Pain (1965)[1], which proposed the ability to control pain through selective activation of large nerve fibers. In this case, the SCS activates nerve tracts in the dorsal spinal cord columns to reduce perception of pain.[3] To strengthen medical education, students should be exposed to these concepts early in their training through anatomical dissections and case-based learning.

- Implantable pulse generators (stimulators) work through a paresthesia-free mechanism, based on the frequency and amplitude of the electrical impulses they generate.[4] During surgery, the stimulator, connected to electrodes, tests intra-operative paresthesia.[5]

- Advances in SCS technology include customized handheld remote control devices to modulate the delivery of electrical impulses and and could be chargeable through the patient's skin.[3] Medical students should be introduced to SCS technologies during preclinical training and gain practical exposure through OSCEs and M4 electives.

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