

# Novel Chest Tube Embeds Neurostimulation for Pain Management

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## Technology description

Cancer Treatment Centers of America® (CTCA) has designed a novel chest tube that provides neurostimulation to potentially decrease or eliminate the pain associated with chest tube use. The device employs peripheral nerve stimulation (PNS) or transcutaneous electrical nerve stimulation (TENS) via a polymer or metal sheath on the lining of the chest tube to disrupt pain signals traveling from the insertion site to the brain. An external power source allows patients and care teams to tune the stimulation for optimal pain relief.

## Introduction

Each year, more than 900,000 patients in the United States undergo thoracic procedures that require placement of a chest tube to drain fluid and monitor bleeding or air leakage. The discomfort and sometimes extreme pain associated with chest tube placement and use complicates patient recovery and can lead to the prescribing of opioid medications with the potential for dependence and misuse.

To solve this problem, Cancer Treatment Centers of America® (CTCA) has designed a novel chest tube that provides neurostimulation to potentially decrease or eliminate the pain associated with chest tube use. The device employs peripheral nerve stimulation (PNS) or transcutaneous electrical nerve stimulation (TENS) via a polymer or metal sheath on the lining of the chest tube to disrupt pain signals traveling from the insertion site to the brain. An external power source allows patients and care teams to tune the stimulation for optimal pain relief.

This design combines a chest tube and neurostimulation technology to maximize potential to deliver effective pain relief and allow patients to breathe easily. If successful, this could mitigate post-surgery respiratory complications and may decrease the need for opioid-based medications.

## Technology Details

The number of thoracic surgeries requiring a chest tube is expected to increase with our aging population and expanded access to healthcare. As utilization increases and health systems move

toward value-based therapies, technologies that reduce hospital stays and improve patient outcomes are needed.

## How It Works

This CTCA®-developed device includes a chest tube with drainage holes, a PNS or TENS delivery system, a connection cable, and an external power source (see Figure 1). The PNS or TENS delivery system conducts electrical current to stimulate the intercostal nerves in the pleural lining of the chest and to help decrease pain sensation.

Because different nerves and nerve fibers require different types of neurostimulation, the device would be capable of electrically stimulating all three tissue levels simultaneously (i.e., cutaneous, subcutaneous, and musculoskeletal tissues) with the goal to more effectively alleviate the pain associated with chest tube placement. Programmed by an external power source, the device allows caregivers to adjust therapy parameters based on a patient's pain levels and feedback. The PNS or TENS can be provided by a wire mesh, a stimulation sleeve, conductive materials, conductive polymers, electrostimulating leads, and/or electrodes provided to a surface of the chest tube device.

## Figure 1. Chest tube components

### Why It Is Better

Current medical practices employ a combination of pharmaceutical pain management types to decrease or eliminate the pain associated with chest tube placement and use. Side effects include pneumonia due to decreased lung ventilation, opioid dependence and addiction, hyperalgesia syndrome, and drug tolerance. This novel technology developed by CTCA potentially reduces and/or eliminates the need for some of these pharmaceuticals and may mitigate post-surgery respiratory complications, reduce hospital stays, and improve patient outcomes.

### Application area

Surgical procedures to repair thoracic trauma

Pneumothorax

Pleural effusion

Hemothorax

Thoracic surgeries

Lung cancer

Heart surgeries

## Advantages

**Innovative:** Aims to provide simultaneous thoracic pleural drainage and pain relief in a single procedure

**Reduced pain:** Designed to stimulate the intercostal nerves in the pleural lining of the chest to potentially decrease pain sensation and reduce incidents of post-thoracotomy pain syndrome

**Decreased opioid use:** Potentially limits the use of opioid-based pain management methods and subsequent narcotic-related complications

**Easy to use:** Would need no additional surgical steps since the neurostimulating terminals are embedded in the chest tube material

## Institution

[Cancer Treatment Centers of America](#)

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