

# Pain Management Following Thoracic Surgery



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## KEYWORDS

• Postoperative pain • Thoracic surgery • Pain management • Chronic pain

## KEY POINTS

- Managing postoperative pain is critical in reducing postoperative respiratory.
- Postoperative pain results from multiple etiologic factors. There is no one modality that addresses each contributing factor.
- Optimizing pain control while minimizing sedation and respiratory depression are challenging and competing goals, and neuraxial or regional techniques are strongly preferred over primary parenteral analgesia in the immediate postoperative period.
- Epidural anesthesia is the gold standard for treatment; paravertebral nerve blocks are gaining popularity, but can be technically difficult to perform for an inexperienced anesthesiologist.
- Chronic pain complicates all types of thoracic procedures; once established, chronic postthoracotomy pain is difficult to treat. Preventive approaches include regional and neuraxial analgesia and careful surgical technique.

## INTRODUCTION

Postoperative pain following thoracic surgery presents a significant challenge, and multiple factors complicate recovery and pain management for this population. Although opioids are often sufficient for managing pain after other surgical procedures, patients who are candidates for thoracic surgery often suffer from serious pulmonary pathology and are consequently less likely to tolerate adverse effects of opioids on the respiratory system. Considerable comorbidities often exist in thoracic surgical patients, thus further limiting therapeutic options. Thoracic surgical incisions, even those used for video-assisted thoracic surgery (VATS), can result in significant, long-lasting, and intense discomfort, which may lead to so-called postthoracotomy pain syndrome (PTPS) that may persist for years.<sup>1</sup> In addition, postoperative cardiovascular complications from thoracic operations may also complicate

pain management. Tailoring a treatment regimen that adequately addresses these issues can be overwhelming.

Postoperative pain in thoracic patients is multifactorial and incompletely understood. Elements of nociceptive and neuropathic pain may contribute greatly to patient discomfort. The multilayer intercostal incisions, thoracostomy tube insertion, and pleural irritation are intensely painful. Iatrogenic factors, such as inadvertent rib fractures, intentional rib resection, chest tube positioning, and injuries from unrecognized suboptimal intraoperative positioning, can further exacerbate postoperative pain. This diversity of insults can lead to a variety of pain symptoms including stabbing chest pain and pleurisy, throbbing shoulder pain, and burning rib pain. In the chronically opioid-dependent patient, these symptoms may be far more challenging to treat effectively. There is no single pharmaceutical agent

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or route of administration that addresses every individual contributor to pain, and thus treatment regimens should be multimodal and tailored to the patient and procedure. Treating these individual contributors to achieve patient satisfaction is an important primary perioperative goal, and failure to address acute postoperative pain may lead to the development of chronic pain syndromes.

It is now well-established that effective pain prophylaxis and treatment regimens begin with regional and neuraxial anesthesia techniques. Thoracic epidural anesthesia (TEA) is still considered the gold standard for treating postoperative pain. However, the complications of TEA are many and, in rare cases, can be devastating. Although paravertebral nerve block (PVB) has gained popularity as a treatment modality, too few anesthesiologists are comfortable with PVBs. If performed by inexperienced personnel, the patient can suffer from complications including epidural and intrathecal spread of local anesthetic, pneumothorax, nerve injury, and inadequate pain relief. Furthermore, the advent of diverse and numerous oral anticoagulant and antiplatelet agents have increased the potential for neuraxial hematoma and, hence, the contraindications for epidural and paravertebral techniques. Although systemic opioids are repeatedly vilified in this population, they may become the cornerstone of the treatment regimen when the risk of catastrophic bleeding prohibits the use of regional techniques. This article outlines systemic agents, regional techniques (and attendant complications), etiologies of pain following thoracic procedures, and the development and treatment of chronic pain.

## ETIOLOGIES OF PAIN

The major component of acute postthoracotomy pain is attributed to the intercostal incision that spans the skin, subcutaneous tissue, muscle layers (including intercostal muscles, latissimus dorsi, serratus anterior, and the pectoralis major), and parietal pleura.<sup>2</sup> These layers are innervated by nerves with unique origins. Skin, subcutaneous tissues, and intercostal muscles are innervated by the intercostal nerves. The latissimus dorsi and serratus anterior are supplied by the brachial plexus (thoracodorsal and long thoracic nerves, respectively). The parietal pleura has contributions from the intercostal nerves and the phrenic nerve. Intraoperatively, the incision is forcibly retracted, which can lead to crushing of cutaneous or intercostal nerves and further muscle trauma.<sup>3</sup> Although VATS operations decrease the extent of the incision, identical tissue layers are traversed. During inspiration, the chest wall expands causing

stretching of the incision. Without adequate analgesia, the resulting intense pain frequently leads patients to breathe shallowly.

Rib fractures can exacerbate an already painful incision. Patients in this population are often aging and have poor bone mineral density, which can place them at increased risk for fractures. A careful surgeon takes measures to avoid unintended fractures, but vigorous rib spreader insertion and retraction can lead to such injuries. The extensive exposure sometimes required to operate in the thoracic cavity may necessitate sectioning or excising segments of rib (ie, "shingling"). This can certainly reduce postoperative pain, but the periosteal compromise itself is painful nonetheless.

Thoracostomy tubes, frequently placed away from the primary incision, are used to drain blood and reduce iatrogenic pneumothorax. The additional incision is an obvious contributor to pain, but the tube also makes contact with the highly innervated visceral and parietal pleura. During inspiration, the tube can mechanically irritate parietal and more sensitive visceral pleura, resulting in intense discomfort. If the tube is inserted too deeply or malpositioned, the resultant friction can be excruciating. In severe cases, lung injury can occur.

Ipsilateral shoulder pain is a nearly ubiquitous complaint after all types of thoracic operations involving thoracotomy or thoracoscopy incisions and may be the result of phrenic nerve injury or diaphragmatic trauma. Although these two etiologies are especially sinister given their impact on respiratory function and complications postoperatively, it is unlikely that they are solely responsible for all cases of shoulder pain. The elderly frequently have shoulder pathologies that are easily worsened by lateral decubitus positioning. Chest tube irritation can also be referred to the shoulder area. Brachial plexopathies are common in supine procedures, but even more common in the lateral position if pressure points and exaggerated shoulder extension are not closely monitored intraoperatively. It is prudent to perform a focused neurologic examination before and after thoracic surgery.

## *Thoracotomy Versus Video-Assisted Thoracic Surgery*

Minimally invasive thoracic surgical techniques have improved considerably in the past two decades. In general, patients recovering from VATS operations have fewer respiratory complications and have lower pain scores postoperatively. Generally, length of stay following lobectomy via

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