



Improving pain after video-assisted thoracoscopic lobectomy – advantages of a wound retractor camera port

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Pain after thoracic surgery remains the Achilles heel of our discipline. Many techniques have been developed over the years to address postoperative pain to varying degrees of success. It is with this in mind that we reviewed the study by Raveglia *et al.* (1) with great interest. The authors present a single-institution prospective randomized trial comparing use of a wound protector to the standard rigid trocar for the camera port during video-assisted thoracic surgery (VATS) lung resections. This novel technique was first published by the authors in 2016 (2) and is now common practice at their institution. The main study outcome was postoperative pain measured by both visual analog scale as well as morphine consumption.

Postoperative pain represents a significant burden in the acute peri-operative period and also leads to a high incidence of chronic pain syndrome that persists long after the scars have healed. Acute postoperative pain is especially important in lung surgery, given the strong correlation between poor pain control, splinting, and the development of common pulmonary complications such as pneumonia. In fact, historic data suggest major pulmonary complications plague 25% to 49% of patients following open lung resection (3). In the long term, rates of chronic pain associated with thoracotomy range between 21% and 49% at one year after surgery (4). In an attempt to address this high morbidity, a VATS first approach to lobectomy has been adopted at many centers. In multiple studies, the rates of acute and chronic pain are significantly lower with VATS

compared to open lobectomy (5,6). Furthermore, VATS lobectomy has a lower rate of major morbidity compared to open lobectomy (7-9). However, even with a VATS approach to lobectomy, acute and chronic pain persists and is often neuropathic in nature (10).

Although VATS lobectomy is a relatively new approach to surgical treatment of lung cancer, technical improvements continue to evolve (11). Differences in surgical technique in VATS lobectomy include the number of ports used and the approach taken (12,13). One example of this difference in technique is the uniportal technique, which was adopted with the hope of decreasing pain and morbidity. However, no advantages in postoperative pain were found when compared to multiport VATS lobectomy (14).

Other areas of interest for decreasing pain and morbidity after thoracic surgery include innovations in postoperative regimens. The successes of enhanced recovery after surgery (ERAS) in colorectal surgery (15) has led to an interest in applying these principles to thoracic surgery (16). At our own institution, we have had great success with a thoracic ERAS protocol (17). Our protocols, used both in VATS and thoracotomy cases, include preoperative patient education, carbohydrate loading, opioid-sparing analgesia, conservative fluid management, and early ambulation. We have also included the use of a combination of spinal analgesia and liposomal bupivacaine surgeon administered intercostal nerve blocks, a technique which has been demonstrated to significantly decrease postoperative pain (18-20). Used

together, this ERAS protocol has resulted in a significant decrease in morphine equivalents, length of stay, and mean inflation adjusted hospital costs (17).

Despite all of this attention to postoperative analgesia and technical innovation, few groups have examined the VATS instruments themselves in the etiology of postoperative pain. The Alexis wound retractor (WR) was first designed for laparoscopic abdominal surgery; in colorectal surgery it has gained widespread acceptance due to a decrease in wound infections associated with its use (21). In thoracic surgery, Tsunozuka *et al.* were the first to use the WR system, utilizing it in the access incision to improve visualization and decrease postoperative pain (22).

In their manuscript, Raveglia *et al.* hypothesized that changing a rigid camera port for a soft WR would result in decreased pain and wound complications. They named three main limitations of rigid trocars. First, and most importantly, the trocar exerts a large amount of pressure on the intercostal bundle and can lead to injury of the intercostal nerve, increasing the amount of acute and chronic pain. Second, trocar design renders them difficult to operate at the extreme angles necessary for chest surgery. Finally, the authors acknowledge the risk of skin injury from the port itself, which has a tendency to create pressure injuries when used at extreme angles. Therefore, replacing the troublesome rigid port with a soft WR has the potential to address all three of these limitations.

To test their hypothesis, the authors performed a prospective randomized controlled trial. Forty patients undergoing VATS resection for non-small cell lung cancer (NSCLC) were enrolled. All patients underwent a three-port approach, using a 4 cm lateral minithoracotomy in the 5th intercostal space, a low anterior camera port at the top of the diaphragm, and a 1.5 cm port positioned at the same level of the camera port but posterior. Half of the patients had a rigid 11.5 mm trocar camera port and the other half had an extra small (4 cm) WR camera port. A chest tube was placed in the camera port at the end of every case, and pain control was with a paravertebral block and opioid intravenous patient-controlled analgesia. Pain scores were assessed at 6, 12, 24, 48, and 72 hours and total morphine consumption was collected.

The authors found that the total morphine consumption in the rigid trocar group at 72 hours was significantly higher. Additionally, patient reported pain scores were significantly lower in the WR group at the time points collected. Finally, they measured the maximum angulation of the camera port intra-op and found that the WR

allowed more extreme angles. The authors suggest that the gentle nature of the retractor could explain the lower postoperative pain in the WR group. They hypothesize that the membrane of the WR gently enlarges the thoracotomy edges, thereby avoiding compression of the intercostal nerve and eliminating a possible postoperative neuritis. Prior studies evaluating chronic pain after VATS have demonstrated that neuropathic pain plays a considerable role in chronic pain, although this generally has been associated with the access incision (23).

The authors state the limitations of their current study to be a lack of recording of last dose of morphine, which seems unlikely to have an effect on their overall outcomes. They also note that they do not consider a trocarless technique feasible given the torque placed on the intercostal bundle by the camera and the need for constant cleaning of the camera. Indeed, in our own experience this seems unlikely to be feasible given these limitations. In addition to the acknowledged limitations, one other consideration is the length of follow up. This study was designed to be an acute postoperative pain trial, and it accomplished its goal of analyzing and improving early results. However, with the current opioid epidemic (24), combined with a still high rate of postoperative chronic pain in VATS lobectomy, it would be of great interest to see the authors long-term results. Given that much of the chronic post-operative pain is at the camera port, and is often an intercostal neuritis, any means of reducing this potentially-devastating complication would be welcome.

There are two further limitations of the WR camera port not addressed in this manuscript—cost and the inability to use carbon-dioxide insufflation. At our own institution, the extra small Alexis WR costs 48 USD, significantly less than the 12 mm Optiview port commonly used the camera port, which is 98 USD. However, the WR does cost more than using a reusable 12 mm port, although 48 USD is quite a small sum in the overall care of a lobectomy patient. Additionally, there is no ability to insufflate carbon dioxide through a WR, a technique that many thoracic surgeons find valuable. In adopting a WR camera port and therefore abandoning carbon dioxide insufflation, one would have to ensure that lung isolation is adequate for safe and efficient pulmonary dissection.

Despite these limitations, this study offers an exciting and easy way to reduce postoperative pain associated with VATS lobectomy. Hopefully the authors will continue their work and examine the long-term effects of replacing rigid trocars with WRs.

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None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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