



Arts on tailored postoperative analgesia after video-assisted thoracoscopic surgery

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Video-assisted thoracoscopic surgery (VATS) has been widely used in recent decades. However, VATS, although different from an open thoracotomy, causes intense pain (1,2). In some individuals, it remains one of the most painful surgical procedures possible. Poor postoperative pain control after VATS may prolong hospitalization duration and result in the development of chronic persistent pain after surgery (3). However, for different pain sensations after VATS, multimodal analgesia, with or without conventional thoracic epidural or paravertebral analgesia, has become the mainstay for achieving adequate analgesia. The components of multimodal analgesia can be used in different combinations and at different timings. For example, when regional analgesia combinations, such as paravertebral block and intercostal blocks, are used for variable postoperative periods, oral analgesics (acetaminophen/NSAIDs and gabapentinoids) can be introduced when oral intake is resumed. However, to achieve the goals of minimizing opioid use and achieving satisfactory recovery quality for effective respiratory rehabilitation, regional analgesia plays a crucial role in enhancing postoperative recovery after VATS (4).

Giang *et al.* (5) compared analgesic efficacy, respiratory function, and adverse effects between patient-controlled paravertebral analgesia (PVPA) and intravenous patient-controlled analgesia (IVPCA) after VATS lobectomy. They concluded that the PVPA group had significantly lower pain scores at rest at all times and lower pain scores on coughing in the first 4 h. Respiratory profiles were comparable in both the groups from POD1 to POD3.

Because PAVA and PCA were started from a relatively low dosage after surgery, patients were encouraged to establish adequate analgesia in the first hours after surgery either through PAVA or IVPCA. Adequate pain control was not achieved until 2 h after surgery (VAS <3 at rest and VAS <4 on coughing). PAVA resulted in lower pain scores and less use of rescue narcotics in the first 4 h. After the first 4 h, VAS scores at rest or on coughing were acceptable with comparable respiratory functions up to POD3. In terms of adverse effects, the incidence of headache was significantly higher in the IVPCA group (13.3%).

Pain depends on procedures performed for most operations. However, the requirement after thoracic operation may differ from the necessity of retained chest tubes as well as aggressive respiratory rehabilitation. Simple postoperative analgesic approaches depend on surgical stimulation over somatic and visceral pleurae, as well as other particulars as chest tube duration. Massive manipulation over lung parenchyma may induce more visceral pain which interferes postoperative breathing and coughing. The numbers of ports and the dermatomes they involve, rib fractures or not, and the size of chest tubes play more roles on postoperative somatic pain. Regional blockades, such as intercostal nerve blocks or paravertebral blocks, can reduce the pain from surgical wounds and stimulation through parietal pleurae, which may associate with retained chest tubes. In this randomized investigation, some essential surgical and postoperative details were not indicated, including the number of ports for VATS, number of dermatomes involved by VATS, size of chest tubes, time

of chest tube removal, time to healthy oral intake, and requirement of additive oral analgesics.

In VATS, various analgesic medications and techniques with different targets and mechanisms are used. However, aggressive pain control should be started before emergence or immediately after surgery to prevent acute postoperative recovery pain. (6) Although adjuvants, such as dexmedetomidine (7), were reported to improve the quality of postoperative recovery effectively, adequate analgesia remains the most crucial factor on the satisfaction. The analgesic requirement in the very first hours after surgery may vary a lot on different operations and for different individuals. Pain intensity between VATS and thoracotomy mainly differs immediately upon arrival on postoperative care unit from the operating theater (8) In this report, the most painful period was the first 2 h after operation. After achieving a satisfactory analgesic effect with adequate respiration and occurrence of cough in the first 4 h, PAVA did not exert more beneficial effects than IVPCA on pain management and respiratory function. Although a paravertebral block was reported to be as effective as thoracic epidural analgesia with a low incidence of undesirable adverse effects, such as hypotension and urinary retention, the proportion of patients with clinically relevant pain was significantly lower during the first 24 h after VATS than after anterolateral thoracotomy (9). In the clinical practice, the need for analgesia after POD2 depends mostly on retained chest tubes, especially in terms of pain on coughing or mobilization. The sudden movement of chest tubes should, therefore, be avoided to prevent sudden intractable pain.

Conventional VATS can involve the use of up to five instruments, followed by chest drains. Up to five intercostal nerves are at risk of trauma and chronic pain generation due to complete or partial nerve damage. Although VATS is merely an approach and not a new surgical technique, surgeons have attempted to reduce the severity of wounds and the number of ports required. After uniportal VATS (10-12), the number of dermatomes that must be blocked for postoperative analgesia may be lower. Moreover, because of the reconsideration of the necessity of routine insertion of chest tubes after operation (12), tubeless VATS have been introduced (11). Without retained chest tubes or with smaller chest drainage tubes (13), the necessity of a retained catheter or patient-controlled analgesia is theoretically lower. Also, when oral intake is resumed within hours after surgery, oral analgesics can be continued.

For PAVA, although paravertebral catheters enjoy a

100% successful thoracoscopic insertion rate as shown in this report, the number of covered dermatomes is still unpredictable. Only 1 or 2 dermatomes covered by PAVA were observed in up to 15% of patients in the PAVA group. As the authors indicated that the more dermatomes that were blocked, the higher the analgesic efficacy became, the unpredictability of the number of blocked dermatomes may limit the application of PAVA. It would be considerably easier to fit dermatomes to be blocked by using multiple intercostal nerve blocks (14) or by directly injecting liposomal bupivacaine on intercostal nerve blocks (15). A recent survey was conducted in Canada to determine the choice of regional analgesia for VATS, and the results showed that the choice of regional anesthesia depends on the operation and provider's preference (16). For VATS lobectomy, an epidural was preferred in 41% of patients, and PCA was preferred in 27% of patients. For wedge operation, IVPCA was preferred in 46% of patients. For any VATS procedure, the paravertebral block was preferred in only 14% of patients. However, the postoperative analgesic preference differed between different surgical teams. With less requirement of chest tubes or a short duration of retained chest tubes after VATS wedge resection, IVPCA can be beneficial for individually tailored analgesia. When surgical trauma becomes more limited, IVPCA and a single injection of regional blocks may be preferable compared with continuous TEA or paravertebral block due to the low risk and decreased care requirements. The relevance on choosing the combination of different analgesic approach remains on considering the possible components of pain transition from the first hours after surgery to POD2 or POD3. Systemic narcotics with a smaller dosage such as applied in IVPCA are rational to be preferred on pain management on visceral pain combined with minimal somatic pain. For patients requires extensive respiratory rehabilitation immediately after the operation, adequate initial narcotics to facilitate deep breathing and coughing are necessary.

To place the retained analgesic catheters in different spaces precisely, thoracic surgeons play crucial roles in the location of the correct position inside from thoracic cage and insertion of catheters without perforation of parietal pleurae in the paravertebral space (17,18) or intercostal nerve sheath (14,19). Similarly, the analgesic effect of the continuous intercostal block was reported to be comparable to that of paravertebral block (14) However, the effects of nerve blocks depend mostly on surgeon's experience (20) and other drugs applied in multimodal analgesia. The

choice of combinations of analgesia and cooperation between surgical teams tend to fit better with surgical and recovery requirements (21). In addition to minimization of surgical trauma and avoidance of intercostal nerve injuries; surgeons can actively use regional anesthesia for postoperative pain management in VATS (22,23).

Because the goal of a surgical approach is to minimize surgical trauma with a limited inflammatory response (12), innovations and technologies are continuing to be developed (24). However, respect for the oncological criteria of safety and radicality must remain the key consideration in surgical lung cancer therapy. Although postoperative pain control has not been adequately discussed in the context of VATS or thoracotomy, it should be tailored based on the variable intensity of postoperative pain by using different surgical approaches and the anticipated chest drainage requirements. The need for retention catheters for a paravertebral or thoracic epidural can be evaluated based on patients' acceptance, postoperative recovery requirements, and surgeons' and anesthesiologists' preferences. Although retained thoracic epidural or paravertebral analgesia remains the primary choice in VATS with a high risk of conversion to thoracotomy, the use of continuous infusion through a retained catheter might decrease in the future with minimization of VATS operations with more gentle, temperate approach as well as the development of local anesthetics with longer duration.

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