



The best strategy to control pain after thoracic surgery: multimodal strategy against pain

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Pain in thoracic surgery

Pain has always been a concerning and main topic in thoracic surgery. Thoracotomy (was) is the traditional access to reach pleural cavity. This allows to have a very great management of all the thoracic organs through a direct and wide costal split. There are different types of thoracotomies that can be done; each gives different exposure of the thorax and for every case surgeons must be able to adopt one of those for specific necessities (1-9). Surgical approach must be chosen not only on operative target but also evaluating the impact on patient recovery and kind of analgesic therapy available and applicable. A lot of modified procedures, both surgical and analgesic, have been studied and introduced (2); the aim was to reduce the impact on chest wall and subsequently the arise of pain, both acute and chronic that are actually the most frequent and dreadful morbidity (3,4).

Muscle and nerve sparing thoracotomy

Posterolateral thoracotomy (PLT) has been the favorite access for almost every thoracic surgeon during the last years (5-7). This kind of approach ensures an excellent view and access to the pulmonary hilum and mediastinum and can be enlarged in case of surgical emergency. Muscles like latissimus dorsi (LD) and serratus anterior (SA) and sometimes trapezius, rhomboids and paravertebral muscles are often engraved. A lot of studies demonstrated that after this kind of surgery quality of life was made very worse by pain, even after one or two years from surgical procedure (8); for these reasons, other accesses have been proposed in

which major muscles must be preserved: muscle sparing thoracotomy (MST). More than this, reduction of pain can be obtained with nerve sparing thoracotomies (NST) because the problem is that during surgery two neurovascular branches are blemished: on the rib above the nerve is constricted, whereas on the rib below is compressed because of the closure suture. So, avoiding this, pain is decreased. Literature suggests that even an advanced surgical technique as NST does not reduce all post-operative morbidities and these are conditioned by a lot of factors identified in intraoperative, like surgical length, and post-operative, like chest tubes presence and numbers and especially analgesic technique that is used (8-10). A big change came with the advent of video-assisted thoracic surgery (VATS) in the last two decades that made all the attentions focused on evaluation of quality of life between VATS and open surgery. Based on several studies, it has been showed that, in the very first postoperative period, VATS guarantee better outcomes in terms of pain score and pulmonary function impairment (11). The origin of post thoracic surgery pain is very complex. It comes from chest wall and parietal pleura passing through intercostal nerves. Furthermore, it comes from diaphragmatic or mediastinic pleura going through vagus nerve fibers. Including all the factors mentioned of the peri-operative period, different chemical mediators are accountable for pain transmission:

- ❖ Prostaglandins: responsible of hyper-algesia and primary awareness due to the increase in NA⁺ in the cells;
- ❖ Quinines: facilitate inflammatory response and

- fluid leaks from vessels;
- ❖ Serotonin: activation of specific receptors 5-HT₃ and 5-HT₂;
- ❖ K⁺ and H⁺ and reactive oxygen species: directly stimulation of nerve terminations
- ❖ Substance P: directly produces pain.

All these chemical substances contribute in the changing of pain threshold getting it lower and simplifying inception of pain especially for the acute one that arises in the period very after surgery. The other type of pain is the chronic one, that has a longer onset after surgery and is long-lasting; approximately 9% to 80% of patients will develop chronic pain after thoracotomy and more or less from 5% to 33% after thoracoscopy. Patients pain perception could besides be conditioned by many factors, for example female gender, genetical predisposition, young age, anxiety, depression, type of surgery and a high acute pain after procedure. As underlined before, the most important thing that must be done to prevent pain after surgery is to apply a correct analgesia strategy, better a multimodal one.

After surgery analgesia

In 2016 comprehensive guidelines on postoperative analgesia were published, by the American Society of Regional Analgesia and Pain Medicine and the American Society of Anesthesiologists' Committee on Regional Anesthesia. One of the most essential teaching is the importance in using multiple analgesic agents, adopted with different techniques with the purpose to work on different pain paths, to treat the arise of pain after surgery. Another strong recommendation inferred is to use systemic and local-regional analgesia to support opioid-sparing strategies and reduce side effects like, above all, respiratory complications. Concerning analgesia administered intravenously a lot of drugs are usable.

Opioids

Their use was largely common but now no longer counseled. Administrations are various, from continuous through intramuscular, even if now the most habitual way is the patient-controlled analgesia (PCA). Within different type of opioids, Morphine is largely used; it has a rapid onset and a medium duration, but, using it, side effects must be considered and monitored, especially in case of kidney failure. Further, Fentanyl and Sufentanil are often employed

lipophilic opioids with faster onset time and shorter duration compared with morphine. This last drug can also be used for PCA. Sometimes local anesthetics can be used in union for epidural analgesia. Oxycodone is another opioid that can be administered successfully for postoperative pain management of patients undergoing thoracoscopic surgery once they have resumed oral intake. Remaining common opioids are codeine and tramadol; this last can be used in the very postoperative period and acts through two types of paths: activation of mu-opioid receptor and serotonin and norepinephrine reuptake inhibition. Basal infusion of opioids, with or without PCA, must be limited in opioid-naive patients because of the increased risk of side effects, that are a lot, including hypotension, respiratory depression, itching, nausea, vomit, bowel ileus, confusion and sedation. It would be better to avoid or at least reduce the use of these drugs to enhance recovery after VATS lobectomy (10,11). Those drugs still are important components of pain therapy, better administered as a rescue when other non-opioid analgesics fail.

Nonsteroidal anti-inflammatory drugs (NSAID)

With these drugs the use of opioids is reduced but must be considered that there is recurring risk like kidney problems, gastric bleeding and effects on platelets aggregation. Ketorolac is nowadays the preferred one (11-13) but maybe is not the safest that is probably paracetamol, having an opioid saving effect and a very important result on pain control. This drug is usually well tolerated and does not have, has said before, all the potential NSAIDs' side effects but must be carefully used in case of liver pathology because of its hepatotoxicity dose depending. N-methyl-D-aspartate (NMDA) antagonists, magnesium sulphate as an example, work on receptors that can be inhibited limiting postoperative pain and the opioid use. Intravenous application reduces PCA morphine requested. Gabapentinoids are initially antiepileptic agents and commonly used to treat neuropathic pain. The use of these medicine has often the intent to be opioid-sparing and reduce the uprising of neuropathic pain after thoracic surgery. Literature indicates that preoperative administration of gabapentinoids may also reduce postoperative pain and opioid consumption. Sedation, dizziness and visual disturbances are possible side effects so these drugs must be used with caution especially in elderly patients.

Loco-regional analgesia

Thoracic epidural analgesia (TEA) is nowadays considered to be the gold standard technique in pain management, usually recommended to be the first line after thoracic surgery. It provides a better pain relief than opioid PCA treatment and permits a faster recovery. Local anesthetics used with TEA can be associated with opioids to increase the analgesia efficacy. One of the biggest problems is the invasiveness of this technique that cannot be arranged to all patients. There are several other limitations to its use: the need of adequate skilled doctors for its placement and perioperative management and moreover the fact that can cause sympathetic blockade, respiratory depression, urinary retention and, rarely, local complications both during and after procedure. Today, the most used local anesthetics for postoperative TEA are ropivacaine and levobupivacaine. Thoracic paravertebral block (TPVB) is nowadays very used, especially with VATS approach; often is proposed as an alternative to TEA because results in term of pain control are comparable to TEA, but what is more important, is that there are very fewer side effects. Pain in the very immediate post-operative period can be covered with a single shot of TPVB but to have a longer pain coverage, a continuous TPVB analgesia with a catheter placed in the paravertebral space should be associated. This can be carried out with a blind technique, an ultrasound-guided approach or an intraoperatively one performed by the surgeon. The TPVB is easier and safer than TEA to be arranged with very few possible complications. The best local anesthetic concentration for TPVB is not known.

Intercostal nerve block is a very well-known technique, especially to treat pain after thoracotomy. Both the single-shot technique and the continuous infusion are possible, but only this last one seems to be effective after thoracic surgery. The continuous infusion of local anesthetic in the intercostal space provides pain relief comparable to TEA, until approximately the 5th postoperative days after open surgery.

Serratus anterior plane block (SAPB) is an ultrasound-guided thoracic wall nerve block that well covers the lateral cutaneous branch of the intercostal nerves from T2 to T9. The SAPB provides more hemodynamic stability compared with TEA after thoracotomy and reinforces PCA analgesia reducing pain and morphine use. In patients undergoing VATS, the loco-regional technique makes both less pain and opioid consumption in the first 24 hours after intervention. This less invasive technique could be very useful in less

invasive surgery but, despite the promising results, more studies are needed to confirm its effective. However, the SAPB can be considered the second choice when the TPVB is not feasible. It can also be performed before the surgical incision, and associated with intraoperatively TPVB after placement under surgeon's direct view.

What about the paper

Authors have done a great job with this article, comparing patient-controlled paravertebral analgesia (PCPA) with intravenous patient-controlled analgesia (IVCPA) (4). Sixty patients have been considered for the study and underwent VATS lobectomy. Many studies (9-12) demonstrated that the use of PCPA is better than IV therapy concerning pain after thoracotomy and some others demonstrated the feasibility of PCPA for VATS surgery (7,9,13). In this article, a lot of data have been recorded showing the superiority of PCPA. Lung function, recorded pain scale and collateral effects were better in the PCPA group. Evaluating literature about this topic it is possible to assert that today always less centers use IV technique to relief pain, in favor of PCPA or Epidural catheter. As we have seen before this last technique has a lot of contraindication and side effects, due to particular anatomical region and placement technique making nimbler and safer the use of paravertebral catheter. Conclusions of this paper are so consistent with literature. However, some things can be analyzed. In the PCPA group authors use synthetic opioid drug linked with local anesthetic; some studies demonstrated that infusion in paravertebral catheter could be exclusively made with local anesthetic. Avoiding opioids, side effects can be lowered around zero and boost the superiority of this technique on the others. Concerning rescue drug, the argument is almost the same, and some studies demonstrated that the use of paracetamol instead of opioid iv allows to reach the same pain control, knowing that opioids can always be added if necessary (7,8). Another point of interest that is a little bit missing in literature is the long-term follow-up, to understand the best analgesic strategy to decrease or avoid chronic pain. As explicated before, some recent papers underline that a useful technique is the use of muscle block (for example serratus block), that, combined with other techniques, could obtain the best pain control. The paper is well written and the study well developed, and we hope that authors will carry on in examining and improving after surgery pain control.

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