A new technique for continuous intercostal-intrapleural analgesia in videothoracoscopic surgery

Daniele Forcella, MD, Eugenio Pompeo, MD, Filadelfo Coniglione, MD, Antenello Gatti, MD, and Tommaso C. Mineo, MD, Rome, Italy

Videothoracoscopic surgery has reduced the invasiveness of a considerable number of thoracic operations, although optimal postoperative thoracic analgesia remains an open issue.[1] Among commonly used methods, continuous intravenous infusion of analgesics, including opioids and nonsteroidal anti-inflammatory drugs, has shown promise but is not always satisfactory and can have some adverse effects.[2] We developed a new technique of continuous intercostal-intrapleural analgesia (CIIA) in videothoracoscopic lung resections, which is based on a double-catheter pain relief system (On-Q Pain Buster; I-Flow Corp, Lake Forest, Calif) to provide continuous infusion of ropivacaine (Figure 1, *A*).

TECHNIQUE AND RESULTS

At the end of the operation, under thoracoscopic vision, we place the first catheter just below the parietal pleura and along the vascular-nervous intercostal bundle, which crosses the passage of the chest tube; care is taken to push the catheter as close as possible to the costovertebral junction (Figure 1, *B*). The second catheter is connected with a double-lumen chest tube (26 F) to permit anesthetic release from the tube's extremity directly onto the pleuric dome (Figure 1, *A*).

The 2 catheters are connected with the pump that allows a continuous infusion of ropivacaine (2 mg/mL) at a flow of 2 mL/h for each catheter (overall flow of 4 mL/h; Figure 2). Proper priming of the catheters is important as any trapped air may impair the catheters' performance; moreover, intermittent aspiration of the catheter during placement helps recognize incidental intravascular placement.

Between January and April 2006, a short pilot study was carried out to test feasibility and efficacy of this method. Eleven patients undergoing videothoracoscopic pulmonary wedge resections received CIIA. A written informed consent was obtained from all patients.

Primary outcome measures included technical feasibility, assessment of thoracic pain according to the visual-analogue pain scale (VAS), the number of nursing-care calls, interleukin-6 plasma levels, additional analgesics needed, and duration of air leaks and hospital stay. Results were compared with a similar control group undergoing continuous intravenous analgesia (CIA) with tramadol and ketorolac during the same period.

In the study group, technical feasibility was excellent in 10 patients and good in 1 due to the development of a limited subpleural hematoma. There were no complications or collateral adverse effects.

Intergroup comparisons (CIIA vs CIA) at 24 and 48 hours showed a VAS of 2.3 ± 0.9 versus 3.3 ± 1.0 ($P = .005$) and 1.6 ± 0.8 versus 2.1 ± 0.6 ($P = .02$), respectively, whereas nursing-care calls were 3.4 ± 0.8 versus 3.9 ± 1.2 ($P = .2$) and 2.5 ± 0.9 versus 3.4 ± 0.8 ($P = .001$), respectively. Interleukin-6 levels were 73 ± 9 versus 82 ± 10 ($P = .01$) and 38 ± 11 versus 46 ± 13 ($P = .06$), respectively. Additional analgesics within 48 hours were necessary in 3 versus 8 patients, respectively ($P = .04$). Mean durations of air leaks and hospital stay were 1.7 ± 1.7 versus 2.6 ± 2 ($P = .1$) and 2.5 ± 1.5 versus 3.6 ± 1.8 ($P = .04$), respectively.

DISCUSSION

Morbidity in thoracic surgery can be affected by the efficacy of postoperative pain management[3] as impaired ventilation and coughing due to thoracic pain can trigger the sequence of inadequate clearance of secretions–atelectasis–pneumonia.

Currently, different methods are used for pain management. Thoracic epidural analgesia is considered the gold standard[4] but may be somewhat oversized for many thoracoscopic procedures. As a result, the optimal analgesic regimen for videothoracoscopic procedures is still debated. Continuous infusion of nonsteroidal anti-inflammatory drugs is also commonly used but may cause gastrointestinal problems and bleeding. Opioids are often administered as a systemic analgesic therapy but have collateral effects including respiratory depression, nausea, vomiting, and constipation.

This new analgesic technique is aimed at treating the main pain-triggering points in videothoracoscopic surgery, which relates both to the intercostal space chosen for the chest tube passage and the parietal pleura, which can be irritated by the chest tube during lung expansion. We reasoned that by inhibiting pain at these 2 sites with long-acting local anesthetics, optimal thoracic analgesia could be achieved with minor side effects. Moreover, placement of the catheter

From the Cattedra di Chirurgia Toracica, Policlinico Università Tor Vergata, Rome, Italy.

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Address for reprints: Eugenio Pompeo, MD, Cattedra di Chirurgia Toracica, Policlinico Università Tor Vergata, V.le Oxford, 81, 00133 Rome, Italy (E-mail: pompeo@med.uniroma2.it).

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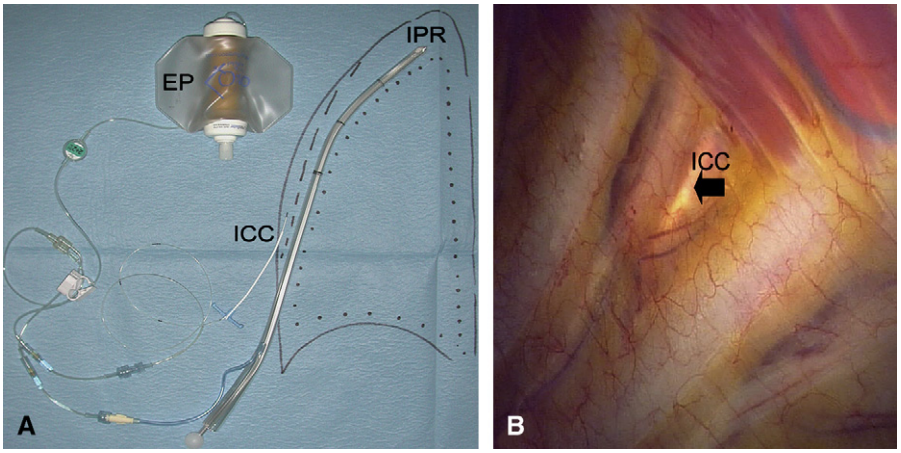

FIGURE 1. Schematic illustration of the CIIA method showing the elastomeric pump *(EP),* the intercostal catheter *(ICC),* and the second elastomeric pump catheter, connected to a double-lumen chest tube for high intrapleural release *(IPR)* of ropivacaine (A). Intraoperative thoracoscopic vision during transthoracic subpleural insertion of the intercostal catheter (ICC, *black arrow*) (B).

beneath the parietal pleura under thoracoscopic vision reduces the risk of catheter dislocation, which has been reported in up to 20% of patients.[5] Finally, it is easy to place the catheter close to the costovertebral junction, to reach the posterior branch of the intercostal nerve that transmits painful impulses from the posterior part of the intercostal space.

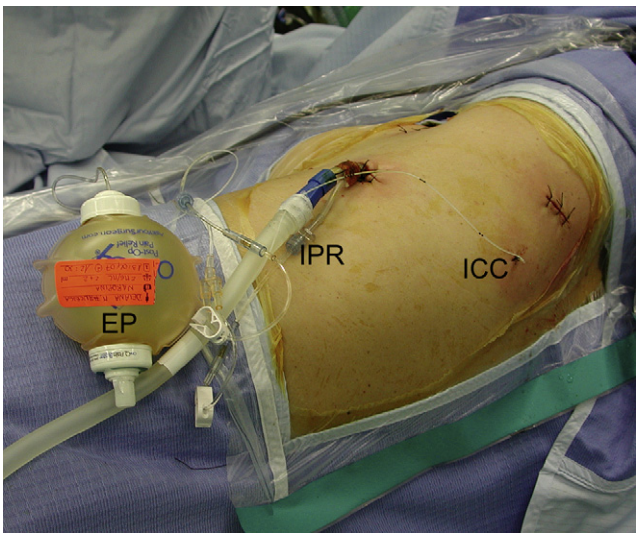

FIGURE 2. Immediate postoperative view showing the elastomeric pump *(EP),* the intercostal catheter *(ICC),* and the double-lumen chest tube connected to the pump for high intrapleural release *(IPR)* of ropivacaine.

We conclude that in patients having thoracoscopic lung resection, CIIA proved easy, safe, and effective in ensuring adequate thoracic analgesia. Moreover, comparison with CIA results revealed that CIIA proved somewhat better in terms of VAS, interleukin-6 production at 24 hours, nursing-care calls at 48 hours, and duration of hospitalization. Further investigation is welcome to eventually confirm our promising preliminary findings.

References

1. Hill SE, Keller RA, Stafford-Smith M, et al. Efficacy of single-dose, multilevel paravertebral nerve blockade for analgesia after thoracoscopic procedures. *Anesthesiology*. 2006;104:1047-53.
2. Gottschalk A, Cohen SP, Yang S, Ochroch EA. Preventing and treating pain after thoracic surgery. *Anesthesiology*. 2006;104:594-600.
3. Debreceni G, Molnar Z, Szelig L, Molnar TF. Continuous epidural or intercostal analgesia following thoracotomy: a prospective randomized double-blind clinical trial. *Acta Anaesthesiol Scand*. 2003;47:1091-5.
4. Wurnig PN, Lackner H, Teiner C, et al. Is intercostal block for pain management in thoracic surgery more successful than epidural anaesthesia? *Eur J Cardiothorac Surg*. 2002;21:1115-9.
5. Conacher ID, Korki M. Postoperative paravertebral block for thoracic surgery. A radiological appraisal. *Br J Anaesth*. 1987;59:155-61.