Four-Step Local Anesthesia and Sedation for Thoracoscopic Diagnosis and Management of Pleural Diseases*

Marcello Migliore, MD; Riccardo Giuliano, MD; Tarek Aziz, FRCS†; Rasheed A. Saad, FRCS†; and Francesco Sgalambro, MD

Study objectives: Most thoracic surgeons perform thoracoscopy under general anesthesia using a double-lumen endotracheal tube. We describe our own technique for performing thoracoscopy under local anesthesia and sedation.

Design, setting, patients: Forty-five patients underwent the procedure under local anesthesia and sedation (mean age, 64 years; age range, 40 to 92 years). A known history of cancer was present in 12 patients. American Society of Anesthesiology score was I in 1 patient, II in 16 patients, III in 22 patients, IV in 5 patients, and V in 1 patient. Premedication was comprised of droperidol, 5 mg, and atropine, 0.5 mg, administered 20 min before the scheduled operating room time. Sedation was maintained by diazepam injection, 3 mg. Four-step local anesthesia in the planned intercostal space using 10 mL of ropivacaine, 7.5 mg/mL, was performed.

Results: Mean operative time was 45.7 min (range, 20 to 90 min); mean time of anesthesia was 71.3 min (range, 30 to 150 min). Among patients with pleural effusion, 23 effusions were simple and 16 effusions were complex. Talc was administered in 28 patients. Complications were intraoperative bleeding (one patient), hyperpyrexia (eight patients), and atrial fibrillation (two patients). The mean time for removal of the chest drain was 5.6 days (range, 2 to 13 days). Postoperative hospital stay was 6.4 days (range, 2 to 14 days). No hospital mortality occurred. Follow-up is complete in all patients (mean, 92.8 days; range, 31 to 270 days).

Conclusion: Four-step local anesthesia and sedation is a simple and effective method of performing a video-assisted thoracic procedure to diagnose and treat simple thoracic pathologies.

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Key words: local anesthesia; pleural diseases; sedation; thoracoscopy

Abbreviations: ASA = American Society of Anesthesiologists; VATS = video-assisted thoracic surgery

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to perform video-assisted thoracic surgery (VATS) under local anesthesia and sedation to diagnose and treat simple thoracic pathologies.

**Materials and Methods**

**Study Population**

Between October 1998 and August 2000, 125 patients were referred to the Department of General Thoracic Surgery at the University of Catania for minor thoracoscopic procedures. Preoperative evaluation included chest radiography, thoracentesis (when indicated), respiratory function tests, and ECG. Flexible bronchoscopy and chest CT were performed when clinically indicated.

Criteria of inclusion in the study group were: (1) the presence of an intrathoracic pathology that does not necessarily require the use of a double-lumen tube or need for intrathoracic or mediastinal dissection, and (2) the absence of coagulopathy or cardiac dysfunction. Informed consent was obtained from all patients, and the possibility of endotracheal intubation and thoracotomy was emphasized.

Forty-five patients entered our study protocol (26 men and 19 women; mean age, 64 years; age range, 40 to 92 years). A known history of cancer was present in 12 patients: lung (n = 5), breast (n = 5), thymus (n = 1), and kidney (n = 1). Hepatic cirrhosis was present in two patients. Data are expressed as mean, SD, and range.

**Anesthesia and Surgical Technique**

Noninvasive BP, ECG, and oxygen saturation (via pulse oximetry) were continuously monitored during surgery. Oxygen was administered via a facial mask. A peripheral IV cannula was inserted for the administration of IV fluids and drugs. Premedication was comprised of 5 mg of droperidol and 0.5 mg of atropine administered 20 min before scheduled operation time. In the operating room, the position of the patient was generally full lateral, although some procedures were performed with the patient in supine or anterolateral positions. We employed the technique of VATS through a single trocar as previously described.

Sedation was maintained by diazepam injection of 3 mg. Three minutes later, local anesthesia was injected in the planned intercostal space, corresponding to the site of thoracoscopic port, using 10 mL of ropivacaine, 7.5 mg/mL, in four subsequent steps (Table 1).

The first step was the injection into the epidermis followed by a 2-cm skin incision, above and parallel to the rib, and the dissection through the subcutaneous tissue; the second step started when the dissection was carried out to the aponeurosis of the thoracic muscles, which is not an insensitive structure, so that another injection of anesthetic solution was necessary before its opening. Then, in the third step, after palpating the rib with the index finger, we went on making the incision through the thickness of the muscular wall down to the rib. The fourth step consisted of anesthetizing the pleura by infiltration through the thickness of the intercostal muscles above the rib for 3 to 4 cm. The incision was then made with diathermy above the rib until the parietal pleura was visualized and, just before the pleura was opened, an IV bolus of propofol was administrated (30 to 60 mg IV in 10 to 15 s). After entering the pleura under direct vision, the index finger was used to explore the chest to avoid any damage to the lung, if adhesions were present, and finally the trocar was inserted.

Periods of decreased oxygen saturation were controlled with the facial mask, increasing the liters of oxygen per minute. During the operation, propofol was injected (by demand), and plasma expanders were used to treat the hypotension secondary to propofol.

The instrumentation and the drugs for general anesthesia were always available in the operating room. Postoperatively, a chest radiograph was obtained daily to ensure full lung expansion and to check for any pneumothorax or residual effusion. The intercostal underwater seal drainage was generally under suction for 24 to 48 h, and it was removed the day after the procedure or when the drainage was < 100 mL/d.

**Results**

The indications for thoracoscopy are shown in Table 2. Respiratory function tests demonstrated mean FVC of 1.84 L/min (SD, 0.7; range, 1.29 to 2.59 L/min) and FEV₁ of 1.31 L (SD, 0.47; range, 0.70 to 1.80 L). Nine patients had FEV₁ < 1.0 L. Mean percentage of FEV₁ was 62.0% (SD, 15%; range, 39 to 96%). ASA scores are shown in Figure 1.

Mean operative time was 45.7 min (range, 20 to 90 min). The average time for anesthesia was 71.3 min (range, 30 to 150 min). Among patients with pleural effusion, 23 effusions were simple and 16 effusions were complex. Talc (3 to 5 g) was administrated in 28 patients.

Complications included one patient with intraoperative bleeding that required a single-lumen intubation (2.2%) and a 5-cm minithoracotomy, eight

### Table 1—Summary of the Four-Step Method of Thoracoscopy Under Local Anesthesia and Sedation

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Injection of anesthetic solution into the epidermis of the planned intercostal space and dissection through the subcutaneous.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2</td>
<td>Injection of anesthetic solution under the aponeurosis of the thoracic muscles.</td>
</tr>
<tr>
<td>Step 3</td>
<td>Incision through the thickness of the muscular wall down to the rib.</td>
</tr>
<tr>
<td>Step 4</td>
<td>Anesthesia of the parietal pleura by infiltration through the thickness of the intercostal muscles and its opening under direct vision.</td>
</tr>
</tbody>
</table>

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### Table 2—Indication for Thoracoscopy in the Study Population

<table>
<thead>
<tr>
<th>Indication of Thoracoscopy</th>
<th>Patients, No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleural effusion</td>
<td>39</td>
</tr>
<tr>
<td>Pleural thickening</td>
<td>4</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>1</td>
</tr>
<tr>
<td>Huge mediastinal mass</td>
<td>1</td>
</tr>
</tbody>
</table>
patients with hyperpyrexia, three patients with hypotension, and two patients with atrial fibrillation. Chest drainage was under suction of $-20 \text{ cm H}_2\text{O}$ for 1 to 2 days, and the mean time for removal was 5.6 days (range, 2 to 13 days). Postoperative hospital stay was 6.4 days (range, 2 to 14 days). No hospital mortality occurred. Follow-up is complete in all patients (mean, 92.8 days; range, 31 to 270 days). No long-term complications requiring thoracoscopic intervention occurred during the follow-up.

**Discussion**

Rusch and Mountain\(^4\) reported in 1987 the advantages of thoracoscopy under regional anesthesia to diagnose and manage pleural disease, and Danby et al\(^5\) described the use of local anesthesia and sedation to treat pleural effusion with talc pleurodesis. More recently, VATS has been performed under local and epidural anesthesia or with sedation to treat secondary pneumothorax in high-risk patients, and to perform thoracoscopic wedge resection\(^6,7\).

The intercostal space where the incision is planned is generally anesthetized using a simple injection of local anesthetic that involves the tissues from the skin down to the intercostal muscle. Such a procedure is useful in very thin, debilitated patients, but it is not effective in the obese patient or patients with thick muscles because it is difficult to obtain effective anesthesia of the pleura, and therefore pain and vagal reflexes can develop. Our four-step technique of local anesthesia has the main goal of giving optimal anesthesia of the pleura even in the obese patient. Therefore, a painless introduction of the thoracoscope can take place. To achieve the best results, it is imperative with our technique to perform an open ultra-minithoracotomy of 2 cm and to anesthetize the tissues under direct vision. So far, we have not experienced any arrhythmias during the procedure, only in the postoperative period in the patients who underwent talc pleurodesis.

In cases of pleural effusion, we suggest that the fluid not be evacuated just before the operation. We agree with Rusch and Mountain\(^4\) that patients with pleural effusion tolerated the procedure extremely well because they are used to functioning with a partial lung collapse. Complex pleural effusions are characterized by the presence of loculations that are not sensitive; therefore, our technique is the preferred method to break the loculations. The fact that nine patients had preoperative FEV\(_1\) of $<1 \text{ L}$ suggests that this technique can be used safely in patients with compromised pulmonary function.

When pleurodesis with talc insufflation is indicated, we have found it to be more effective to insufflate at the end of expiration. However, in lightly sedated patients with less-compromised lung function, insufflation was carried out while the patients held their breath for 5 to 10 s. Rusch and Mountain\(^4\) reported a completely painless use of talc in all their patients, but 2 of 28 patients had slight pain; therefore, we prefer to administer

![Figure 1. ASA status in the 45 patients.](http://journal.publications.chestnet.org/pdfaccess.ashx?url=/data/journals/chest/21979/)
more sedation before the administration of talc. In conclusion, the described technique is a simple and effective way of performing VATS under local anesthesia and sedation to diagnose and treat simple thoracic pathologies.

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