**Official title:comparative study of nonintubated uniport thoracoscopic surgery using thoracic paravertebral nerve block versus intercostal nerve block for peripheral solitary pulmonary nodule patients**

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## Protocol study

**Nonintubated spontaneous breathing anesthesia preparation and implementation**

The same protocol for nonintubated, spontaneous breathing anesthesia was used for both groups of patients, as described previously [9]. All patients were administered intravenous propofol (target-controlled infusion, 2–3.5 μg/mL) and sufentanil (0.1 μg/mL). When the bispectral index (BIS) dropped to 60, a laryngeal mask was immediately placed and connected to the breathing circuit. Before making the skin incision, all patients were sedated with administration of intravenous propofol (1.5–2 μg/mL) by using the method of total venous anesthesia (TCI), remifentanil (0.05–0.08 μg/kg/min), and dexmedetomidine (0.5–1 μg/kg/h) to achieve a BIS of 45–60. During the procedure, the patients were able to breathe spontaneously through the laryngeal mask to maintain the oxygen saturation at levels greater than 90%.

**Early-stage preparation for uniportal minor lung resection technique**

The surgical procedure for nonintubated spontaneous breathing uniportal VATS for patients with a solitary peripheral lung nodule has previously been described in detail[9]. A 3-cm-long incision was made at the level of the fifth or sixth intercostal space and INB and surface anesthesia were induced by administration of 1% lidocaine (2 mL). Visceral pleura was anesthetized using 2% lidocaine (5 mL). The intrathoracic vagus nerve was blocked by the injection of 0.5% ropivacaine combined with 2% lidocaine (2.5 mL) at a point adjacent to the vagus nerve as well as at the level of the aortopulmonary window on the left side and at the level of the lower trachea on the right side. The blockade of the vagus nerve reduced the cough reflex for several hours, which allowed sufficient time to perform the minor wedge lung resection.

**Paravertebral nerve block or intercostal nerve block based on the regional anesthesia for nonintubated anesthesia**

For PVB group, the single port was established along the upper edge of the spinous process of the thoracic vertebral body at the T4 thoracic interspace at a point that was equidistant from the upper and lower intercostal spaces. Using the epidural needle (Tuohy 18G, Braun, Melsungen, Germany), the injection was made 3 cm lateral to the midline. The paravertebral space was entered by advancing the epidural needle over the upper edge of the transverse process. The path of the epidural needle and the entrance of the needle tip into the thoracic paravertebral space were continuously monitored by thoracoscopy. Then, an injection of 1% lidocaine (10 mL) combined with 0.5% ropivacaine (10 mL) into the paravertebral space was administered, causing the uplifting of the parietal pleura.

For the INB group, the intrathoracic INB at the T3, T4, or T5 intercostal space was performed under thoracoscopic guidance by the administration of 1% lidocaine (10 mL) and 0.5% ropacaine (10 mL) using a 25-gauge top-winged infusion needle.

**Uniportal minor lung resection**

Through the single-port incision, the presence of the lung nodules was confirmed by manual palpation or instruments or by preoperative CT-guided localization.

Wedge lung resection was performed by using an articulating endoscopic linear cutter (Echelon 45 Endopath stapler; Ethicon Endo surgery Corp, OH, USA), with 4.5 cm or 6.0 cm cartridges. The regular specimen collection bags were used for the extraction of the resected specimens. The resected lung parenchyma was forwarded to the pathology department for confirmation of the histological nature of the frozen specimens. If pathologic examination of the frozen specimen confirmed that the lesion was a benign tumor, such as tuberculoma, fungal infection, or inflammatory pseudotumor, the current surgical margin was considered to be reasonable.

**Air leakage monitor and incision closure without the chest tube drainage**

At the end of the surgery, the patients were checked for air leakage by observation during the gradual inflation of the collapsed lung. The operated lung was washed with warm saline, and manual continuous-assisted mask ventilation was applied until the collapsed lung tissue expanded to its -full volume.

The re-expansion of the lung, performed under thoracoscopic guidance, was achieved by the insertion of a suction catheter connected to a negative-pressure suction device. When lung re-expansion was visually confirmed, the suction catheter was removed and the uniportal incision was rapidly closed with continuous sutures.

**Intravenous morphine anesthesia pump postoperatively**

The postoperative protocol was the same for both the groups. All patients were allowed to remain in the recovery room for 1 to 2 hours after the operation before being transferred to the general ward. Postoperative patient-controlled analgesia with intravenous morphine was administered with the following conditions: 150 mg morphine in 150 ml NS, 1 mg/mL, only bolus dose; 1 mg per bolus; lockout interval, 10 min) was administered.

**Ramsay sedation scale**

Sedation was assessed by Ramsay sedation scale including1 score being anxious and agitated or restless or both,2 scores being cooperative, oritented and tranquil,3 scores being responding to commands only,4 scores being brisk response to light glabellar tap or loud auditory stimulus,5 scores being sluggish response to light glabellar tap or loud auditory stimulus.

**Chest radiography and thoracic ultrasonography during the early postoperative stage**

In both the groups, chest radiography and thoracic ultrasonography were performed 4 hours after the operation, i.e., during the early postoperative stage, in order to assess the degree of pneumothorax or pleural effusion. If pneumothorax was present or if the patient had moderate or severe pleural effusion, leading to clinical deterioration of the patient’s respiratory status, a chest tube was implanted for drainage.

**Discharge and follow-up for the patients**

Patients in both groups were considered fit for discharge if severe pneumothorax was absent and/or pleural effusion was moderate, as assessed by chest radiography or ultrasonography. Follow-ups of all the enrolled patients were conducted in the outpatient department at 7 days and 1 month after the operation; the patients also underwent chest radiography at the time of follow-up.