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ORIGINAL ARTICLE

Thoracoscopic surgery under epidural anesthesia for intractable secondary spontaneous pneumothorax

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Summary *Objective:* Surgical intervention might be required in secondary spontaneous pneumothorax (SSP) with prolonged air leak; however, operation under general anesthesia (GA) could be critical in compromised patients. In this study, we performed video-assisted thoracic surgery (VATS) under epidural anesthesia (EA) in compromised patients with SSP and evaluated its feasibility.
Methods: Of 212 patients who underwent VATS for SSP, 179 patients had surgery under GA and 33 under EA from 2006 to 2014. All medical records were retrospectively reviewed for operative time, pre- and postoperative chest tube drainage, postoperative complications, and hospital death. To evaluate the efficacy of VATS under EA, these factors were compared between EA and GA groups.
Results: The mean operative time and the mean duration of postoperative drainage, respectively was 106.2 ± 45.3 minutes and 6.15 ± 10.51 days in GA, and 102.6 ± 43.1 minutes and 6.10 ± 7.20 days in EA. Of 18 cases with recurrence and 13 cases with complications, only one recurrence and one complication developed in EA.

Conflicts of interest: The authors declare that they have no conflict of interest.

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Conclusion: In case with patients having intractable SSP with compromised pulmonary function, VATS under EA could be an effective and safe option to approach the appropriate goals of air leak control and less recurrence of pneumothorax.

1. Introduction

Secondary spontaneous pneumothorax (SSP) usually develop from underlying lung diseases, and could be fatal despite appropriate treatment. Although conservative treatment could be a treatment option, surgical intervention might be required for patients with prolonged air leakage.[1–4] In these cases, even though video-assisted thoracic surgery (VATS) is generally performed under general anesthesia (GA), epidural anesthesia (EA) could be considered in compromised patients who are intolerable to GA.[5–8] Recent articles have reported that awake surgery under EA could be applied in various thoracic diseases.[5–10] In selected patients who are expected to have high risk of postoperative complications, we performed VATS under EA and evaluated its feasibility.

2. Methods

From 2006 to 2014, 291 patients underwent VATS for SSP in our hospital. Of them, 79 patients who underwent wedge resection using endostapler were excluded due to control bias in postoperative prolonged air leak. Of 212 patients, 179 patients had surgery under GA and 33 under EA. The preoperative characteristics of patients in this study are listed in Table 1.

Table 1 Perioperative characteristics

	GA ($n = 179$)	EA ($n = 33$)	p
Age (y)	63.8 ± 12.8	62.03 ± 15.34	0.4
Sex (male: female)	150:29	24:9	
Preoperative chest tube drainage (d)	11.84 ± 15.71	11.23 ± 8.17	0.40
Pulmonary lung function			
FEV1/ FVC	61.93 ± 9.02	18.40 ± 2.55	< 0.001*
D_{LCO}	66.84 ± 5.75	22.57 ± 6.22	0.24
Preoperative dyspnea score based on ATS	1.73 ± 0.49	3.07 ± 0.25	< 0.001*
Underlying lung diseases	0	1	
COPD	174	33	0.015*
ILD	41	10	0.03*

* Statistically significant difference.
ATS = American Thoracic Society; D_{LCO} = diffusing capacity of carbon monoxide; EA = epidural anesthesia; FEV1 = forced expiratory volume in 1 second; GA = general anesthesia.

Surgical intervention was considered in SSP with persistent air leak for more than 7 days, collapse of functional lung due to huge bullae, and more than two recurrences. However, EA was applied to patients with at least one of the following:

- poor pulmonary function test (PFT), such as forced expiratory volume in one second (FEV1) of less than 1.2 L;
- FEV1/FVC (forced vital capacity) less than 40%;
- diffusing capacity of carbon monoxide (D_{LCO}) of less than 60%;
- dyspnea grade greater than Grade 3 based on American Thoracic Society score;
- arterial blood gas analysis on room air showing $PaCO_2$ greater than 50 mmHg;
- PaO_2 less than 60 mmHg;
- elderly (age > 70 years); and
- poor cardiac function, such as moderate to severe pulmonary hypertension, or coronary artery occlusive disease (Figure 1).

All medical records were retrospectively reviewed for operative time, pre- and postoperative chest tube drainage, number of postoperative chest tubes, postoperative complications, postoperative hospital stay, and hospital death. To evaluate the efficacy of VATS under EA, these factors were compared between EA and GA groups.

This study was approved by the institutional review board of Pusan National University, Busan, Korea. Informed consent was not required for this retrospective study.

2.1. Surgical technique for VATS under EA

An epidural catheter was inserted at the T6-7 or T7-8 level before operation; 6—7 ml of 0.75% ropivacaine and fentanyl 50 μg were injected to block T2—T10 dermatome. Under lateral decubitus position, two or three incisions were made and parietal pleura was opened under direct vision to insert an air-locking trocar (Safe Pass Trocar; Vaxcon Co., Incheon, Korea). To collapse the lung and allow sufficient space for manipulation, the air-locking trocar was left open to let air into the pleura. After the 30° 10-mm thoracoscope was introduced, air leak point was identified in the pleural cavity filled with distilled water by applying suction through the trocar (Figure 2A,B). Adhesion was released by precautious minimal dissection due to the fragile lung parenchyma.

To control the air leak point, bullae ligation using a pretied commercial endoloop was usually performed (Figure 2C). To reduce the recurrence of pneumothorax,