**Supplementary Methods**

**Standard** **Anesthesia Procedures**

Patients were routinely monitored with electrocardiogram, pulse oximetry, electrical impedance tomography, response entropy, and train-of-four stimulation. An arterial line (radial) and a central line were established under local anesthesia, allowing intermittent blood gas analyses and continuously monitoring of cardiac index (by FloTrac/Vigileo).

Patients were preoxygenated (inspired oxygen fraction [FiO2] of 0.8) for three minutes before tracheal intubation. FiO2 was maintained at 0.3 during anesthesia. All patients received intravenous midazolam (0.05 mg/kg), propofol (1-2 mg/kg), cis-atracurium (0.2 mg/kg), and fentanyl (2 μg/kg) for induction. Tracheal intubation was accomplished 2-3 min after anesthetic induction. Bilateral subcostal and lateral transversus abdominis plane blocks were applied for intraoperative and postoperative analgesia (two separate injections on each side, 60 ml of 0.25% ropivacaine and 4 mg dexamethasone in total). Propofol and remifentanil (0.1-0.25 μg/kg/min) were administered to achieve a response entropy of 40-60. Cis-atracurium was used to provide sufficient muscle relaxation (train-of-four stimulation < 25%). Heart rate and blood pressure were maintained within +/- 25% range of the baseline value during the surgery. Neostigmine (0.03 mg/kg) and atropine (0.015 mg/kg) were used to reverse the neuromuscular block at the end of surgery. Patients in both groups underwent similar emergence and extubating procedures in the operating room, then sent to PACU until fully awake and satisfactory with pain control.

A stroke volume variation (SVV)-based goal-directed therapy protocol was adopted. In brief, boluses of 250 mL colloid were administered over 15-20 min if SVV was ≥ 13%. An additional bolus would be given if the stroke volume increased by more than 10%. Small doses of phenylephrine, norepinephrine, or ephedrine were administered as required to maintain the mean arterial pressure above 60 mmHg.

A multimodal approach was employed to achieve adequate postoperative analgesia (visual analogue scale [VAS] below 3). This included bilateral subcostal and lateral transversus abdominis plane block, acetaminophen (1 g PO q8hr), parecoxib (40 mg IV q12hr), tramadol (50-100 mg PO as needed), and morphine (IV only for breakthrough pain or for patients who were unable to tolerate PO). Respiratory physiotherapies on a daily basis including early ambulation, two sets of ten deep breaths followed by three effective coughs, and incentive spirometry were started immediately after surgery by physiotherapists or attending nurses. Other elements of ERAS, such as prevention of nausea and vomiting, no nasogastric tubes, and early oral nutrition, were all applied in the perioperative period.

**Electrical impedance tomography (EIT) and computed tomography (CT) scanning**

EIT images, in a color-coding scheme, representing ventilation distribution were generated by tidal impedance changes, correlating well with variations of gas volume (blue for an intermediate change, white for a strongest change, and black for no change).1 The EIT image could be divided into four regions of interest from ventral to dorsal with equal height. The combination of two ventral regions was considered as the non-dependent lung area, while the combination of two dorsal regions was deemed as the dependent part. The change of ventilation distribution in the four regions of interest, in the non-dependent or dependent area could be calculated respectively.

The total lung area and the area of atelectasis or pleural effusion in CT scan were measured by accurately delineating the contours of both lungs at 5-10 mm above the dome of the right hemidiaphragm at end-expiration. The percent of atelectasis or pleural effusion (area of atelectasis or pleural effusion / total lung area) was calculated using EBM PACS Server (version 6.1c, EBM technologies, China). The detailed method was in accordance with previous studies.2,3 All CT scans were assessed by two radiologists both blinded to group assignment and patient outcomes with disagreements settled by a third consultant.

**Derivative measurements**

Oxygenation index, driving pressure, alveolar-arterial oxygen tension difference, intrapulmonary shunt (QS/QT), respiratory index, ratio of dead space to tidal volume (VD/VT), and respiratory power (collectively called derivative measurements) were calculated as previously reported.4-7 The calculations are listed as following:

(1) Oxygenation index = PaO2/FiO2. PaO2: arterial partial pressure of oxygen; FiO2: fractional concentration of inspired oxygen (%).

(2) Qs/Qt = (PA-aDO2\*0.0331)/[PA-aDO2\*0.0331+(CaO2-CvO2)]. PA-aDO2: alveolar-arterial O2 tension difference; CaO2: arterial oxygen content; CvO2: mixed venous oxygen content.

(3) Respiratory index = PA-aDO2 / PaO2.

(4) VD/VT = 0.32 + 0.0106 (PaCO2 - ETCO2) + 0.003 (RR) + 0.0015 (age). PaCO2: arterial partial pressure of carbon dioxide; ETCO2: end-tidal carbon dioxide; RR: respiratory rate, bpm.

(5) respiratory power = RR\*{△V2 \* [1/2 \* ELrs + RR\* (1 + 1:E) / (60 \* 1:E) \*Raw] + △V\*PEEP. △V: tidal volume; ELrs: elastance of the respiratory system; I:E: inspiratory-to-expiratory time ratio; Raw: airway resistance.

**References:**

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