**Supplementary appendix**

------for the article titled 'Intra-operative open-lung ventilatory strategy reduces postoperative complications after [laparoscopic](https://cn.bing.com/dict/clientsearch?mkt=zh-CN&setLang=zh&form=BDVEHC&ClientVer=BDDTV3.5.1.4320&q=%E5%AF%B9%E4%BA%8E%E8%85%B9%E8%85%94%E9%95%9C%E7%BB%93%E7%9B%B4%E8%82%A0%E7%99%8C%E6%89%8B%E6%9C%AF%E7%9A%84%E6%82%A3%E8%80%85) colorectal cancer [resection](https://cn.bing.com/dict/clientsearch?mkt=zh-CN&setLang=zh&form=BDVEHC&ClientVer=BDDTV3.5.1.4320&q=%E8%82%A0%E7%99%8C%E5%88%87%E9%99%A4%E6%9C%AF%E7%9A%84%E6%82%A3%E8%80%85%E7%94%B1%E4%BA%8E%E5%B9%B4%E9%BE%84%E6%99%AE%E9%81%8D%E5%81%8F%E9%AB%98%E3%80%81%E8%82%BA%E8%84%8F%E5%82%A8%E5%A4%87%E5%8A%9F%E8%83%BD%E4%B8%8B%E9%99%8D%EF%BC%8C%E6%9C%AC%E8%BA%AB%E5%B0%B1%E5%A4%84%E4%BA%8E%E8%82%BA%E5%8A%9F%E8%83%BD%E7%9A%84%E8%BE%B9%E7%BC%98%E7%8A%B6%E6%80%81): A randomized controlled trial'

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# 1. Pre-operative risk index for postoperative pulmonary complications

|  |  |
| --- | --- |
| **Pre-operative risk factor1,2** | **Point Value** |
| Type of surgery |  |
| Abdominal aortic aneurysm repair | 15 |
| Upper abdominal | 10 |
| Age |  |
| **≥** 80 years | 17 |
| 70–79 years | 13 |
| 60–69 years | 9 |
| 50–59 years | 4 |
| Functional status |  |
| Totally dependent | 10 |
| Partially dependent | 6 |
| Weight loss > 10% in past 6 months | 7 |
| History of chronic obstructive pulmonary disease | 5 |
| General anesthesia | 4 |
| Impaired sensorium | 4 |
| History of cerebrovascular accident | 4 |
| Blood urea nitrogen level |  |
| **<** 2.86 mmol l-1 | 4 |
| 7.85–10.7 mmol l-1 | 2 |
| **≥** 10.7 mmol l-1 | 3 |
| Estimated intra-operative blood transfusion amount > 4 units | 3 |
| Emergency surgery | 3 |
| Steroid use for chronic condition | 3 |
| Current smoker within 1 year | 3 |
| Alcohol intake > 2 drinks day-1 in past 2 weeks | 2 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Risk Class** | Risk Class 1 | Risk Class 2 | Risk Class 3 | Risk Class 4 | Risk Class 5 |
| 0–15 points | 16–25 points | 26–40 points | 41–55 points | > 55 points |

# 2. The procedures of lung recruitment manoeuver (LRM)

A stepwise increment of the tidal volume was used for each LRM, as previously described.3-5 We set PEEP at 12 cmH2O and respiratory rate at 6 breaths min-1, then increased tidal volume in steps of 4 ml kg-1 of PBW until the plateau pressure reached 30–35 cmH2O and hold mechanical ventilation settings for 3 breaths. Then, we set respiratory rate, PEEP, and tidal volume back to the values preceding the LRM. A LRM should not be performed if mean arterial pressure (MAP) is ≤ 65 mmHg or heart rate is ≤ 45 beats min-1, and RM should be stopped if MAP reaches ≤ 55 mmHg or heart rate reaches ≤ 45 beats min-1.

# 3. Predicted body weight (PBW)

PBW was calculated according to a predefined formula6 with: 50 + 0.91 \* (centimeters of height – 152.4) for males and 45.5 + 0.91 \* (centimeters of height – 152.4) for females.

# 4. Ventilators and monitors

In each group, patients were ventilated using the volume-controlled ventilation strategy using an anesthesia ventilator: (1) Avance® (Datex-Ohmeda, General Electric, Helsinki, Finland); (2) Fabius Tiro® (Dräger, Lübbeck, Germany). Patients were monitored using an monitor: Datex Ohmeda S/5® (GE Healthcare Finland Oy, Helsinki, Finland).

# 5. Definitions for pulmonary complications

Major postoperative pulmonary complications were defined as acute respiratory failure, suspectedpneumonia and sustained hypoxaemia.

(1) Suspected **pneumonia**:1,5,7-9

Patient receives prophylactic antibiotics and meets at least one of the following criteria:

(i) the presence of new and/or progressive pulmonary infiltrates on chest X-ray plus two or more of the following: (a) fever ≥ 38.5°C (core temperature); (b) leukocytosis with white blood cell (WBC) count of ≥ 12 ×109 l-1 or neutrophil > 80%; (c) purulent sputum; (d) new onset or worsening cough or dyspnea.

(ii) without chest X-ray and in the absence of other infectious focus (i.e., urinary or biliary tract infection, intestinal obstruction, intra-abdominal abscess or anastomotic leakage), and the presence of three or more of the following criteria: (a) fever ≥ 38.5°C (core temperature); (b) leukocytosis with WBC count of ≥ 12×109 l-1 or neutrophil > 80%; (c) purulent sputum; (d) new onset or worsening cough or dyspnoea.

(2) **Acute respiratory failure**:7-9 *P*aO2 < 60 mmHg or SpO2 < 90% in room air lasting more than one minute at follow-up when awake.

(3) **Sustained hypoxaemia**: SpO2 ≤ 92% in room air lasting more than one minute at follow-up when awake for more than consecutive three days.

**Definitions in post hoc analysis of pulmonary complications**

(4) **Modified acute respiratory failure**: met the criterion of acute respiratory failure in twice follow-up or acute respiratory failure with sustained hypoxaemia.

(5) **Severe respiratory failure**: Experienced an invasive or noninvasive ventilator therapy, or *P*aO2 < 60 mmHg or SpO2 < 90% when administering oxygen via a nasal catheter at 3 l min-1 or more.

# 6. Definitions for intra-operative ventilation strategy related complications

**Pneumothorax**: defined as the presence of air in the pleural space with no vascular bed surrounding the visceral pleura,8 diagnosed during the operation and within 3 days after surgery.

**Potentially harmful hypotension**: Mean arterial pressure (MAP) ≤ 55 mmHg lasting longer than 1 minute.

**Need for vasopressors**: Mean arterial pressure (MAP) ≤ 55 mmHg or the need for a vasopressor, as assessed by an anesthesiologist, when MAP < 65 mmHg.

# 7. Definitions for postoperative extrapulmonary complications

Major extrapulmonary complication includes sepsis, severe sepsis, septic shock and death within 7 postoperative days. All complications are assessed based on previously defined criteria. 10  
**(1) Systemic inflammatory response syndrome (SIRS)** is defined as those who meet the following two or more criteria: (i) Core temperature > 38°C or < 36°C. (Core temperature is rectal or tympanic). If oral, inguinal or axillary temperatures are used, add 0.5°C to the measured value. (ii) Heart rate > 90 beats min-1. If patient had an atrial arrhythmia, record the ventricular rate. If patients have a known medical condition or are receiving treatment that would prevent tachycardia (for example, heart block or beta blockers), they must meet two of the remaining three SIRS criteria. The most deranged value recorded must be used. (iii) Respiratory rate > 20 breaths min-1 or a *P*aCO2 < 32 mmHg or mechanical ventilation for an acute process. (iv) WBC count of > 12 ×109 l-1 or < 4 ×109 l-1 or neutrophil > 80%.

**(2) Sepsis** is defined as (i) A clear site of infection and at least compliance with the SIRS diagnosis; (ii) The specific site of infection refers to the presence of microbial growth in the blood or other sterile areas, or the formation of abscesses, or the presence of tissue or organ infections (e.g., pneumonia, peritonitis, urinary tract infection, endovascular infection, soft tissue infection, etc.).

(3) **Severe sepsis** is defined by sepsis plus at least one organ failure, hypotension or hypoperfusion.

(4) **Septic shock** is sepsis-induced hypotension despite adequate fluid resuscitation along with the presence of perfusion abnormalities.

(5) **Acute myocardial infarction** is defined11as a rise of Troponin with at least one of the following: (i) Symptom of ischaemia; (ii) electrocardiogram changes indicating new ischaemia (new ST-T changes or new left bundle branch block); (iii) development of pathological Q waves in the electrocardiogram.

(6) **Modified postoperative** hospital stay: On the basis of the primary outcome analysis population, this analysis excluded the patients who had none of the primary outcome events but had a postoperative hospital stay more than 10 days.

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