Appendix 1. Outcome definitions.

Pulmonary study variables:

1. Atelectasis: defined by chest X-ray images suggesting lung opacities with a shift in the mediastinum, hilum, or hemidiaphragm toward the affected area and compensatory overinflation in the adjacent non-atelectatic lung.

2. Hypoxaemia: defined as SpO2 of 92% or less on room-air or SpO2 of 95% or less with FIO2=0·5. Postoperative PaO2<60 mmHg or a PaO2/FIO2<300 mmHg on room-air.

3. Severe acute respiratory failure: Postoperative PaO2<60 mmHg on room air, a PaO2/FIO2<300 mmHg or SpO2<90% requiring non-invasive or invasive ventilation.

4. ARDS: according to the Berlin definition (Ranieri VM, Rubenfeld GD, Thompson BT, et al. Acute respiratory distress syndrome: the Berlin Definition. JAMA 2012; 307:2526-33).

5. Respiratory infection: patient had received antibiotics for a suspected respiratory infection and fulfilled one or more of the following criteria: new or changed sputum, new or changed lung opacities, fever, white blood cells count >12 x 109 l-1.

7. Early extubation failure or requirement of reintubation.

8. Pleural effusion: chest x-ray with the presence of costo-phrenic angle blunting, displacement of adjacent anatomical structures, and blunting of the hemidiaphragmatic silhouette in the supine position.

9. Pneumothorax: air in the pleural space and the mediastinum shifted to the opposite side (a thorax radiography will be performed in suspected cases of auscultation hoarseness).

10. Aspiration pneumonitis: respiratory failure after the inhalation of regurgitated contents.

11. Bronchospasm: presence of expiratory wheezing treated with bronchodilators.

12. Dyspnoea.

Appendix 2: Demographic and preoperative data.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Neuromuscular blockade reversal** | |  |  |
|  | **Spontaneous** | **Pharmacological** | **Total** | **p** |
| **Nº** | 440 | 483 | 923 |  |
| **Age (years)** | 66 [58 to 75] | 67 [57 to 74] | 66 [57 to 75] | 0.656 |
| **Gender (male]** | 262 (60) | 320 (66.7) | 582 (63.5) | 0.035 |
| **Body mass index (kg.m-2)** | 26 [23.5 to 28.5] | 25.75 [23 to 28.8] | 25.8 [23.2 to 28.7] | 0.732 |
| **Ideal body weight (kg)** | 61.4 [55 to 67.7] | 61.8 [54 to 67.3] | 61.8 [54.6 to 67.4] | 0.793 |
| **SpO2 (FiO2 0,21)** | 98 [96 to 99] | 97 [96 to 99] | 97 [96 to 99] | 0.440 |
| **Hb pre-surgery (g.dl-1)** | 12.8 [11.3 to 14] | 12.8 [11.5 to 14] | 12.8 [11.4 to 14] | 0.850 |
| **Hypertension** | 178 (40.5) | 203 (42) | 381 (41.3) | 0.627 |
| **DM** | 69 (15.7) | 82 (17) | 151 (16.4) | 0.595 |
| **OSAS** | 7 (1.6) | 6 (1.2) | 13 (1.4) | 0.653 |
| **COPD** | 22 (5) | 24 (5) | 46 (5) | 0.983 |
| **ARISCAT index (high)** | 330 (75.9) | 374 (78.2) | 704 (77.1) | 0.392 |
| **ASA physical status** |  |  |  | 0.840 |
| I | 24 (5.5) | 32 (6.7) | 56 (6.1) |  |
| II | 234 (53.4) | 250 (52) | 484 (52.7) |  |
| III | 174 (39.7) | 194 (40.3) | 368 (40) |  |
| IV | 6 (1.4) | 5 (1) | 11 (1.2) |  |
| **Randomization group** |  |  |  | 0.020 |
| 1 individualized perioperative | 112 (25.5) | 115 (23.8) | 227 (24.6) |  |
| 2 individualized intraoperative + postoperative CPAP | 111 (25.2) | 116 (24.0) | 227 (24.6) |  |
| 3 standard intraoperative + postoperative CPAP | 92 (20.9) | 142 (29.4) | 234 (25.4) |  |
| 4 standard perioperative | 125 (28.4) | 110 (22.8) | 235 (25.5) |  |

Data expressed as number (%) or median [25th percentile to75th percentile) as appropriate.

SpO2: peripheral blood oxygen saturation; Hb: hemoglobin; DM: diabetes mellitus; OSAS: obstructive sleep apnea syndrome; COPD: chronic obstructive pulmonary disease; ASA: American Society of Anesthesiologists physical score; CPAP: continuous positive airway pressure.

Appendix 3: Intraoperative respiratory values.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Neuromuscular blockade reversal** | |  |  |
|  | **Spontaneous** | **Pharmacological** | **Total** | **p** |
| **OL PEEP (mmHg)** |  |  |  |  |
| 1 hour from ventilation | 6 [5 to 10] | 7 [5 to 10] | 6 [5 to 10] | 0.186 |
| End of surgery (mmHg) | 6 [5 to 10] | 7 [5 to 10] | 7 [5 to 10] | 0.287 |
| **Tidal volume (mL.kg-1 ideal weight)** |  |  |  |  |
| Baseline | 7.99 [7.86 to 8.08) | 7.99 [7.86 to 8.08) | 7.99 [7.86 to 8.08) | 0.622 |
| 1 hour from ventilation | 7.98 [7.86 to 8.07) | 7.98 [7.83 to 8.08) | 7.98 [7.85 to 8.08) | 0.691 |
| End of surgery | 7.99 [7.86 to 8.08) | 7.98 [7.83 to 8.08) | 7.98 [7.86 to 8.08) | 0.098 |
| **Plateau pressure (mmHg)** |  |  |  |  |
| Baseline | 15 [13 to 18) | 15 [13 to 18) | 15 [13 to 18) | 0.901 |
| 1 hour from ventilation | 19 [15 to 23) | 19 [16 to 23) | 19 [16 to 23) | 0.639 |
| End of surgery | 17 [15 to 20) | 17 [14 to 21) | 17 [14 to 20) | 0.849 |
| **Crs (ml.cmH2O-1)** |  |  |  |  |
| Baseline | 50 [40 to 60) | 50 [40 to 60) | 50 [40 to 60) | 0.584 |
| 1 hour from ventilation | 44 [33 to 58) | 45 [33.4 to 58) | 45 [33 to 58) | 0.829 |
| End of surgery | 50 [40 to 62) | 51.3 [41 to 63) | 50 [41 to 62) | 0.918 |
| **PaO2/FiO2 (mmHg)** |  |  |  |  |
| Baseline | 402 [318 to 472) | 415 [325 to 493) | 406 [322 to 482) | 0.098 |
| 1 hour from ventilation | 416 [331 to 500) | 433 [341 to 507) | 425 [336 to 504) | 0.104 |
| End of surgery | 401 [322 to 487) | 438 [342 to 513) | 425 [330 to 502) | 0.003 |
| **PaCO2 pressure (mmHg)** |  |  |  |  |
| Baseline | 38 [34 to 41) | 38 [35 to 42) | 38 [35 to 42) | 0.034 |
| 1 hour from ventilation | 39 [36 to 43) | 41 [36 to 45) | 40 [36 to 45) | 0.013 |
| End of surgery | 39 [36 to 43) | 40 [37 to 45) | 40 [36 to 44) | <0.001 |
| **Driving pressure (cm H2O)** |  |  |  |  |
| Baseline | 10 [8 to 13) | 10 [8 to 13) | 10 [8 to 13) | 0.982 |
| 1 hour from ventilation | 11 [9 to 15) | 11 [8 to 15) | 11 [8 to 15) | 0.404 |
| End of surgery | 9 [8 to 12) | 9 [7 to 11) | 9 [7 to 12) | 0.241 |
| **Number of RM** | 1 [1 to 2) | 2 [1 to 3) | 1 [1 to 2) | 0.002 |
| **Number of successful RM** | 1 [1 to 1) | 2 [1 to 2) | 1 [1 to 2) | 0.002 |
| **Number of unsuccessful RM** | 0 [0 to 0) | 0 [0 to 1) | 0 [0 to 1) | 0.801 |

Data expressed as median [25th percentile to 75th percentile).

OL: open lung; PEEP: positive end-expiratory pressure; Crs: static lung compliance; PaO2/FiO2: arterial oxygen pressure to inspiratory oxygen fraction ratio; RM: recruitment manoeuvres.

Appendix 4: Intraoperative data and neuromuscular blockade reversal.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Neuromuscular blockade reversal** | |  |  |
|  | **Spontaneous** | **Pharmacological** | **Total** | **p** |
| **Volume of fluids administered (ml)** | 2000  [1400 to 3000] | 2000  [1500 to 3000] | 2000  [1500 to 3000] | 0.587 |
| **Volume fluids (mL.kg-1.h-1)** | 10 [7 to 14] | 10 [8 to 14] | 10 [7 to 14] | 0.428 |
| **Volume of crystalloids (ml)** | 1755  [1200 to 2500] | 1800  [1300 to 2500] | 1800  [1250 to 2500] | 0.403 |
| **Volume of crystalloids (mL.kg-1.h-1)** | 9.09 [6.38 to 12.7] | 8.86 [6.21 to 12.63] | 8.97 [6.26 to 12.66] | 0.699 |
| **Volume of blood products (ml)** | 0 [0 to 0] | 0 [0 to 0] | 0 [0 to 0] | 0.315 |
| **Estimated blood loss (ml)** | 250 [100 to 400] | 250 [150 to 500] | 250 [100 to 500] | 0.272 |
| **Diuresis volume (ml)** | 300 [180 to 500] | 300 [200 to 450] | 300 [200 to 500] | 0.358 |
| **Duration of surgery (min)** | 200 [150 to 260] | 200 [150 to 255] | 200 [150 to 260] | 0.587 |
| **Surgery type (laparoscopic)** | 178 (42.5) | 187 (42.5) | 365 (42.5) | 0.996 |
| **Duration of MV (min)** | 240 [180 to 320] | 240 [180 to 300] | 240 [180 to 310] | 0.300 |
| **NMB monitoring** | 60 (13.6) | 230 (47.6) | 290 (31.4) | <0.001 |
| **NMBAs used (B/A)** | 191/244  (43.9/56.1) | 87/401  (17.7/82.3) | 278/645  (30/70) | <0.001 |
| **ET baseline (ºC)** | 35.9 [35.6 to 36.1] | 36 [35.7 to 36.3] | 36 [35.6 to 36.2] | <0.001 |
| **ET 1 hour from surgery (ºC)** | 35.7 [35.1 to 36] | 35.9 [35.5 to 36.2] | 35.8 [35.3 to 36.1] | <0.001 |
| **ET end of surgery (ºC)** | 35.9 [35.3 to 36.4] | 36 [35.6 to 36.5] | 36 [35.4 to 36.4] | 0.023 |
| **MAP baseline (mmHg)** | 79 [69 to 90] | 77 [69 to 86] | 78 [69 to 89] | 0.137 |
| **MAP 1 hour from surgery (mmHg)** | 80 [70 to 90] | 80 [72 to 91] | 80 [71 to 90] | 0.310 |
| **MAP end of surgery (mmHg)** | 78 [69 to 88] | 78 [70 to 86] | 78 [70 to 87] | 0.604 |
| **CI baseline (ml/min/m2)** | 2.5 [2.05 to 3.1] | 2.5 [2.1 to 2.9] | 2.5 [2.1 to 3] | 0.659 |
| **CI 1 hour from surgery (ml/min/m2)** | 2.6 [2.28 to 3.1] | 2.7 [2.3 to 3.1] | 2.7 [2.3 to 3.1] | 0.820 |
| **CI end of surgery (ml/min/m2)** | 2.78 [2.4 to 3.2] | 2.8 [2.4 to 3.2] | 2.8 [2.4 to 3.2] | 0.731 |

Data expressed as number (%) or as median [25th percentile to 75th percentile] as appropriate. MV, mechanical ventilation; NMB, neuromuscular block; NMBAs, neuromuscular blocking agents; B/A, benzylisoquinolines/aminosteroidal**;** ET. Oesophageal temperature; MAP, mean arterial pressure; CI, cardiac index.