**supplementary material (SM)**

**NIV adjustment**

We informed all attending doctors of the characteristics of the study and explained predefined criteria for all relevant interventions and clinical decisions. Apart from prophylactic NIV applied in the interventional group, clinical management of patients during their ICU stay was undertaken according to the evaluation of the attendant physician.

In the NIV group (group N) noninvasive ventilation was explained to the patient before application(2hours after surgery). Physicians were responsible for prophylactic NIV implementation, which included choice and fitting of masks, adjustment of ventilator settings, and initial patient adjustment. NIV was administered in a semi recumbent position with an ICU ventilator (NELLCOR PURITAN BENNETT 840 VENTILATOR SYSTEM).

Prophylactic NIV modalities was delivered through a facial mask( Dräger NovaStar and ClassicStar ). Initial prophylactic NIV settings were the following: an inspiratory positive airway pressure of 8 cm H2O and an expiratory positive airway pressure of 4 cm H2O. Initial settings could be modified if necessary, adjusting inspiratory positive-airway pressure according to patients’ tolerance (12–20 cm H2O) to achieve a respiratory rate less than 25 breaths per min with an estimated tidal volume around 8 ml/kg and minimal air leaks. FiO2 was set to achieve SaO2 ≥92%.Air leaks were reduced by carefully fitting the mask on the patient, focusing on leaks around nasogastric tube. In most patients, nasogastric tubes were placed during surgery and were maintained by surgeons. Inspired gases were heated and humidified by a conventional heated humidifier (PN-2000F/FA Respiratory Humidifier).

Prophylactic NIV(group N), applied for approximately 30 to 45 min at 2- to 4-h intervals for 48 h following surgery(total 8-12hs/day), depending on the patient’s clinical condition. Between each NIV period, the patient received supplemental oxygen through venturi facemask to achieve an oxygen saturation level above 92 %.

All Patients were mobilized as early as possible (after evaluation of the surgeon) following surgery. Prevention of venous thromboembolism included low molecular weight heparin and graduating compression stockings. Apart from prophylactic NIV applied in the interventional group, clinical management of patients during their ICU stay was undertaken according to the usual clinical guidelines. All patients also received daily respiratory physiotherapy. Mucolytics and/or bronchodilators were administered if required.

An independent committee including an ICU physician, a chest physician, and a radiologist validated all ARE according to the definition. For this purpose, they reviewed all relevant data from patients’ medical records including chest X-rays and/or CT-scans, and bedside flowcharts at entry and during the study.

Follow-up

During the ICU days of stay after surgery, patient heart rate (HR), pulse-oximetry(saO2), blood pressure, and respiratory rate (RR) were continuously monitored. We recorded the arterial blood gas values(preoperative, immediate postoperative, daily for two days ). chest X-ray features were recorded preoperative , at admission in the ICU (before initiation of prophylactic NIV)and then at least once a day. Each patient was examined and screened for postoperative complications at least once a day or in cases of clinical change.

**Definitions**

* We defined ARF as the presence and persistence of at least two of the following: respiratory acidosis (arterial pH <7.35 together with PaCO2 >50 mm Hg); arterial O2 saturation by pulse-oximetry of less than 90% or PaO2 lower than 60 mmHg at FiO2 of 0.5 or Venturi facemask ≥ 10 l/min; respiratory rate greater than 30 breaths per min; clinical signs of ARF, i.e. cyanosis, sweats, involvement of accessory respiratory muscles, paradoxical abdominal motion, consciousness impairment
* For patients’ allocated to the prophylactic NIV group, rescue therapy consisted in reinstitution or continuation of NIV beyond the scheduled time. In addition to criteria for immediate re-intubation, when patients who received rescue therapy with NIV showed deterioration of blood gases (arterial pH, PaCO2, PaO2) or tachypnea despite optimal use of NIV, NIV was not prolonged for more than 4 h and then patients were re-intubated.(1)
* If a patient from either treatment group met criteria for ARF, but did not fulfill criteria for immediate reintubation, the use of NIV was permitted as rescue therapy, prior to reintubation if needed
* For the two groups, the decision to perform endotracheal intubation was made by the attending physician, according to the usual criteria used in the ICU was based either on (a) one of the following major criteria: respiratory or cardiac arrest; persistent severe hypoxemia (PaO2/FiO2˂130 mmHg) despite NIV; hemodynamic instability with systolic blood pressure ˂ 85 mmHg despite adequate vascular fluid expansion; severe cardiac arrhythmia; or (b) at least two of the following minor criteria: ineffective ventilation due to agitation and/or major air-leaks under NIV; clinical signs of ARF, i.e., respiratory rate > 35/min and/or pH < 7.20. or worsening of ARF under NIV; consciousness deterioration or encephalopathy score worsening under NIV; bronchial hypersecretion under NIV; development of other organ failure.

Infectious complications

* Pneumonia was diagnosed by the presence of new and/or progressive pulmonary infiltrates on chest radiography, plus two or more of the following criteria: fever (> 38°C), leukocytosis (> 12x109/L), purulent sputum, or isolation of pathogen in respiratory secretions.(2)
* Lower respiratory tract infection was defined as the presence of purulent tracheobronchial secretions plus two or more of the following criteria: fever (>38°C), leukocytosis (>12x109/L), or significant bacteriologic counts in respiratory secretions, without new pulmonary infiltrates on the chest radiography. (2)
* Atelectasis was defined by reduction in lung volume, loss of aeration and displacement in interlobar fissures on chest radiography, with a rapid improvement after Fiberoptic bronchoscopy and/or chest physiotherapy and/or mechanical ventilation.
* Severe sepsis with other sources

Non infectious complications

* Gastric distension was clinically evaluated by the clinician and confirmed by abdominal radiography, and acute colonic pseudo-obstruction (ACPO) is defined by abdominal distension with massive dilation of the colon in the absence of mechanical obstruction. (2)
* NIV intolerance; patients did not complete the planned prophylactic NIV sessions.
* Skin ulceration

**Tables**

**Table 1 Category of each event used to define ARE in the prophylactic NIV and conventional groups.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Group N(n=50)** | **Group C(n=50** | **p-value** |
| **RR>30** | 13(26) | 15(30) | 0.43 |
| **PaO2/FiO2 < 200** | 10 (20) | 8 (16) | 0.34 |
| **Hypercapnia >10mmHg** | 8(16) | 9(18) | 0.51 |
| **New pulmonary infiltrates** | 3(6) | 4(8) | 0.67 |

**Data are n (%).\*significant p value ˂0.05**

There is no significant difference between the two group of study regarding the events used to define ARE, acute respiratory event defined by at least two of the following criteria: respiratory rate˃30/min, PaO2/FiO2˂200 mmHg, PaCO2 increase of more than 10 mmHg above baseline postoperative value or a new pulmonary infiltrate on chest X-ray. Table 1

**Table 2: factors associated with ARE (univariate analysis) HR Hazard Ratio (95% CI)**

|  |  |  |
| --- | --- | --- |
| **Variable** | **HR (95% CI)** | **(p-value)** |
| **Group**  N group  C group | 0.81(0.39-1.65)  1.0 | 0.55 |
| **Gender**  Male  Female | 0.54(0.21-1.40)  1.0 | 0.12 |
| **age** | 1.01(0.96-1.06) | 0.62 |
| **Smoking (**yes/no) | 1.04(0.47-2.30)/1.0 | 0.91 |
| **Cardiac disease**s(yes/no) | 0.13(0.04-0.40)/1.0 | 0.01\* |
| **Chronic kidney disease**(yes/no) | 0.55(0.64-3.13)/1.0 | 0.60 |
| **COPD**FEV1˂60%  FEV1≥60% | 1.40(1.04-2.02)  1.0 | 0.03\* |

**\* significant p ˂0.05**

**COPD ;chronic obstructive pulmonary diseases,FEV1;forced expiratory volume in 1 second.**

**References**

**1-Lorut C, Lefebvre A, Planquette B, Quinquis L, Clavier H, Santelmo N,et al .(2014).** Early postoperative prophylactic noninvasive ventilation after major lung resection in COPD patients: a randomized controlled trial. Intensive care medicine, 40(2):220-227.

**2-Guerra Hernández E, Rodríguez Pérez AE, Freixinet Gilard J, Álamo M, Escudero Socorro M, Rodríguez Suárez P,et al .(2018).** Prophylactic use of non-invasive mechanical ventilation in lung resection. European review for medical and pharmacological sciences, 22: 190-198.