Authors have nothing to disclose with regard to commercial support.

than usual care. The result of IMT associated with decreased PPCs suggests that the effect of IMT on improving pulmonary outcomes may be even stronger than our analysis suggests.¹ Because of the unclear proportions of laparoscopic or thoracoscopic versus open operations, whether minimally invasive surgery would eliminate the observed effect that patients who had IMT had significantly fewer PPCs after open surgery but not after thoracoscopy or laparoscopy is not certain. These limitations were illustrated in our section on strengths and limitations. Preoperative smoking cessation, correcting preoperative severe anemia, avoidance of general anesthesia in favor of regional anesthesia, protective ventilation, correction of anemia, and improvement of nutritional status all have an effect on PPC prevention.^{8,9} We need to find a higher level of evidence to identify which method is the best way to guide clinical practice.

In conclusion, to meet a higher evidence level and to determine the appropriate surgical candidates and the modalities of physical training when patients undergoing cardiothoracic or upper abdomen surgery, more double-blind and unbiased randomized, controlled trials are necessary.

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THE BENEFIT OF RECRUITMENT MANEUVER DURING NONINVASIVE VENTILATION IN PATIENTS AFTER CARDIAC SURGERY REMAINS UNCLEAR

To the Editor:

In their recent *Journal* article, Miura and colleagues¹ reported that in patients undergoing cardiac surgery with a ratio of Pao₂ to fraction of inspired oxygen less than 300 and a radiographic atelectasis score (RAS) of at least 2, the use of noninvasive ventilation with recruitment maneuver is associated with improved oxygenation, improved RAS, and fewer days of oxygen supplementation during the hospital stay.

Several limitations, however, should be clarified. One important issue is that the blinding of patients and the intensive care unit team cannot be guaranteed in the study of Miura and colleagues.¹ Although the comparison of final Pao₂ at room air between the 2 groups was significant, the absolute difference of Pao₂ was small (67.2 ± 5.9 vs 73.7 ± 7.1 mm Hg; *P* = .007). Because the value of Pao₂ changes continuously during the whole treatment, the selection of Pao₂ in each patient could easily be biased if the investigators were not blinded. Actually, we believe that blinding bias already existed, as we noticed the use of oxygen at intensive care unit discharge was more frequently in the control group (14/16 vs 4/18; *P* < .001), despite the small difference in Pao₂ (6.5 mm Hg). Second, Figure 2 of the article of Miura and colleagues¹ shows that 94.4% of patients in the recruitment group changed to an RAS of 0, versus 12.5% of patients in the control group (*P* < .001). The evaluation was performed by physicians blinded to the group allocation. According the definition of RAS, however, RAS of 0 to 1 (0 without atelectasis, 1 line of atelectasis or discrete infiltration) indicates only

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slight infiltration. In several clinical investigations^{2,3} including the current study of Miura and colleagues,¹ RAS of at least 2 was used as a cutoff point for atelectasis. If this is the case, the proportion of patients with RAS of 1 or less at intensive care unit discharge would be comparable (0/18 vs 2/16; $P = .214$ by Fisher exact test). Third, in the recruitment group, patients received recruitment maneuver during the noninvasive ventilation session with positive end-expiratory pressure (PEEP) of 15 cm H₂O for 2 minutes, 20 cm H₂O for 2 minutes, and then returning to 8 cm H₂O for the remainder. Air leakage is unavoidable during the noninvasive ventilation process, which may lead to a lower PEEP than the set level. More importantly, appropriate PEEP to maintaining lung inflation is a key point during recruitment maneuver. Miura and colleagues¹ should describe how the PEEP of 8 cm H₂O was selected in this trial, such as the lower inflection point in the pressure-volume curve strategy.⁴

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RECRUITMENT MANEUVER MIGHT BE AN OPTION FOR PATIENTS WITH HYPOXEMIA AND ATELECTASIS

Reply to the Editor:

We thank Mr Jiang and colleagues for their interest in our study and we will try to respond to the raised issues.

We acknowledge that the intensive care unit (ICU) team might not be blind to the allocation, although patients from

both groups were submitted to noninvasive ventilation (NIV), because the ventilator parameters needed to be modified during the application of recruitment maneuver, and, as we stated, sometimes it was necessary to hold the mask on patient's face to prevent air leakage. This was stated as a limitation in the report.¹ However, we think it is very unlikely that this could have influenced the evaluation of oxygen arterial pressure (PaO₂), because the researchers did not choose the timing of the PaO₂ assessment. Although the ICU team might not be blind to the patient allocation, PaO₂ is an objective parameter. Besides, the arterial blood gas sample was collected as part of the ICU routine by the laboratory staff. The schedule of blood samples was standardized and was not chosen either by the researchers, or by the ICU staff.

In our study, initial PaO₂ was the first arterial blood sample collected after extubation and the final PaO₂ was the last before ICU discharge. It is important to emphasize that both groups used NIV, besides the time factor, meaning that patients were expected to improve oxygenation. However, we could observe an increase of $12.6 \pm 6.8\%$ of PaO₂ in the control group and $23.3 \pm 8.5\%$ in the recruitment group ($P < .001$). As stated in the study, we used a difference higher than 10% between groups in PaO₂ improvement in the sample size calculation.

Regarding the same subject, the use of oxygen therapy followed the ICU standards, and it was on the basis of arterial blood gas and on the patient's oxygen saturation. Although arterial blood gas evaluates PaO₂ in a specific time, peripheral oxygen saturation is evaluated continuously in the ICU and during the day, it is the parameter that the ICU team uses to indicate the use of oxygen therapy. In our ICU, oxygen is administered by the ICU staff to all of the patients who present peripheral oxygen saturation lower than 92%. Despite small in absolute values, the difference in PaO₂ might be enough for peripheral oxygen saturation that would or would not indicate the use of oxygen therapy during the clinical course of the patients, especially in specific conditions such as acidosis. Additionally, the difference in the length of supplementary oxygen use was found also after ICU discharge, during the ward stay. The ward team, including medical, nursing, and physiotherapy, was not aware of the participation of the patient in the study, therefore, was not aware of the allocation group of the patients. The care team based administration of oxygen on clinical criteria and the researchers were not involved in this decision.

In the matter of the difference in radiologic atelectasis score (RAS), we used a cutoff point of RAS ≥ 2 because we did not think that it would be reasonable to use a recruitment maneuver² in patients with a lower score; however, it does not mean that it is not clinically significant. The fact that we found difference in the time of oxygen use indicate lower levels of atelectasis is related to better oxygenation.