

# Letters to the Editor

## Prone Position and Oxygenation

To the Editor:

I read with great interest the article by Pelosi et al. (1), which showed that  $P_{aO_2}$  was increased by prone positioning during general anesthesia in 14 of 17 patients whom they studied and actually decreased in the remaining three patients. Despite these inconsistent alterations in arterial oxygenation after prone positioning, the authors concluded that prone positioning improves oxygenation.

Even if they noted a statistical difference in the average values of  $P_{aO_2}$  between the supine and prone positions, I believe that there are several limitations to their study and their conclusion may be premature. First, they examined respiratory variables and  $P_{aO_2}$  during only two observation periods: in the supine and then prone position. Thus, there is a possibility that their data reflect not only the effects of positioning but also alterations over time. Yet functional residual capacity, one major determinant for  $P_{aO_2}$ , does not appear to decrease progressively during anesthesia in the absence of any other complicating factor (2). To exclude this possibility, one should also have obtained additional data either after changing the patient from the prone to the supine position or approximately 20–30 min later, again while the patient remained in the supine position. Second, the authors did not mention why they found no relationship between changes in  $P_{aO_2}$  and those in functional residual capacity. Indeed, the reduction in functional residual capacity correlates well with an increase in the gradient of alveolar-arterial oxygen tension during anesthesia with artificial ventilation (2). More importantly, they did not explain why three patients showed reductions in oxygenation after prone positioning despite improvement of functional residual capacity.

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2. Hewlett AM, Hulands GH, Nunn JF, Milledge JS. Functional residual capacity during anaesthesia. III. Artificial ventilation. *Br J Anaesth* 1974;46:495–503.

### In Response:

We wish to thank Dr. Nishikawa for his interest in our article (1). He raised three main points to which we wish to respond.

First, he states that alterations in arterial oxygenation after prone positioning are inconsistent, since in three patients oxygen tension decreased. Our data simply indicate that the prone position during general anesthesia in normal subjects, contrary to common belief (2,3), improves, on average, oxygenation. Similar behavior of oxygenation changes in the prone position has been reported in patients with acute respiratory failure (4).

Second, he states that our data might not reflect only the effects of positioning but also the alterations over time. This is a possibility. However, it has been consistently shown that duration of anesthesia does not cause modifications in respiratory mechanics, oxygenation, and lung volumes, at least in the first hours after induction (5–7).

Third, Dr. Nishikawa, correctly wonders why in three patients the increase in lung volume was associated with a decrease in oxygenation, unlike in the other 17 patients. The effects of prone position on oxygenation may result from a combination of the following mechanisms: 1) changes in regional lung inflation; 2) redistribution of ventilation; and 3) redistribution of perfusion. Thus, it is trivial to

remind ourselves that oxygenation depends on the matching of regional ventilation and regional perfusion (8). We explored only the variation of lung volume. By inference, a regional increase in lung volume may lead to a regional increase in ventilation, if due to the reopening of previously collapsed areas. This is associated with an increase in oxygenation only if the previously collapsed regions were and remained perfused. Accordingly, in absence of regional perfusion and regional ventilation data, we may only speculate on the mechanisms leading to the results we observed. However, in patients with respiratory failure, we found that lung shape modifications, as well as modifications in regional inflation, may be predictive, in individual patients, of early effects of positioning on arterial oxygenation (9).

In conclusion, our data showed that in the majority of the patients during general anesthesia the prone position improves lung volume as well as oxygenation. The increase in oxygenation may be related to an increase in regional lung ventilation. If the perfusion is unchanged, the oxygenation should improve; conversely, if the perfusion changes, an increase in lung volume may be associated with a decrease in oxygenation, but this phenomenon seems to characterize the minority of patients. The precise mechanisms leading to the different response, in individual patients, to prone position need to be elucidated.

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## Autologous Platelet-Rich Plasmapheresis in Repeat Cardiac Surgery

To the Editor:

Shore-Lesserson et al. (1) have concluded that autologous platelet-rich plasmapheresis (PRP) has not reduced postbypass bleeding or transfusion requirements in patients undergoing repeat cardiac surgery. However, several points are raised by their study:

1. If the prothrombin time was similar in the two groups and the transfusion trigger was a prothrombin time greater than 150% of control, how did the PRP group receive more fresh frozen plasma?