Effects of Inverse-Ratio Ventilation on Cardiorespiratory Measurements in Severe Respiratory Failure

To the Editor:

Chan and Abraham's article,1 which appeared in the November 1992 issue of Chest, is a praiseworthy investigation. Severe respiratory failure, either isolated or as a part of multiple organ dysfunction syndrome, is a relatively common entity in intensive care units. Unfortunately, it is associated with a frustratingly high mortality rate and often requires mechanical ventilation with high FiO2 and high airway pressures. Both prolonged exposure to high FiO2 and elevated peak airway pressures have been shown to contribute to the lung injury.23 Newer modes of mechanical ventilation, like pressure-controlled inverse ratio ventilation (PC-IRV), are being used more frequently because they are designed to decrease the peak airway pressure. Therefore, it is important that studies like that of Drs. Chan and Abraham be done to better understand the utility of these modes.

In their study, they found that when PC-IRV was compared with pressure-controlled ventilation with a conventional ratio, PC-IRV was associated with a significant improvement in PaO2, a decrease in shunt fraction, a decrease in PaCO2, and a decrease in dead space, but there was no improvement in oxygen delivery as cardiac output fell. They concluded that inversion of conventional ratios produces no significant improvement in the overall cardiorespiratory profile. Several points, however, need to be stressed. In an attempt to control for the variability of critically ill patients, the authors limited their trial period of PC-IRV to 1 h. This can be misleading, since the full benefits of inverse ratio may not be fully appreciated after 1 h, but continued improvement can be seen up to 6 h later.2

In addition, the authors did demonstrate an improvement in PaO2 with a decrease in the shunt fraction through the use of PC-IRV, which may have important consequences if it allows the physician to taper the FiO2 down to nontoxic levels. This improvement could also allow for a decrease in the extrinsic positive end-expiratory pressure (PEEP). Likewise, the authors demonstrated an improvement in ventilation with a decrease in both PaCO2 and dead space. This improvement would allow the physician to decrease the minute ventilation by decreasing the pressure drive; consequently, peak airway pressure would decrease. Decreasing both extrinsic PEEP and peak airway pressure should reduce the negative effect that PC-IRV had on cardiac output and consequently improve oxygen delivery. In several studies of patients with severe respiratory failure over prolonged times, PC-IRV has been shown to result in significant improvement in oxygenation at lower minute ventilation, lower peak airway pressure, and lower PEEP requirements.67

In summary, I think the authors did commendable job, as it is difficult but necessary to do clinical trials in the intensive care unit. I would caution that although they did not demonstrate an immediate improvement in oxygen delivery after 1 h of PC-IRV as compared with pressure-controlled ventilation with conventional ratio, improvement might have been seen with a more prolonged trial of PC-IRV or with improvement in cardiac output through reduction of extrinsic PEEP and peak airway pressures (maneuvers afforded by the demonstrable improvement of shunt fraction and reduction in dead space by PC-IRV). Further studies still need to be performed.

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REFERENCES
1 Chan K, Abraham E. Effects of inverse ratio ventilation on...