Ventilatory Support and Pulmonary Barotrauma

During the past decade refinements in both apparatus and techniques of ventilatory support have proliferated. In some disease entities, such as idiopathic respiratory distress syndrome of the newborn (IRDS), significant decreases in mortality have been seen. In others, such as the adult respiratory syndrome (ARDS), improved survival has not been so clearly documented. Nevertheless, most clinicians involved in critical care medicine seem to agree that mechanical ventilation, positive end-expiratory pressure (PEEP), and continuous positive airway pressure (CPAP) are mainstays of therapy against life-threatening acute ventilatory insufficiency.

As is often the case, however, a price is paid for such therapeutic advances: in this case pulmonary barotrauma—a frequently serious and potentially lethal complication of therapy. Reported incidences of this complication range from 10 to 20 per cent. Cullen and Caldera herein report a phenomenally low incidence of 0.5 per cent in a group of 200 critically ill patients who needed mechanical ventilatory support with and without PEEP or CPAP. They suggest that previously (and presumably future) published figures should be compared with their low baseline figure of less than 1 per cent.

Before doing so, we must ask several questions. The study reported is retrospective, and as such, is subject to the problems of observation and controls of all retrospective studies. In this case, however, the number and diversity of individuals who looked for and reported positive evidence of barotrauma does seem adequate to insure that few, if any, undetected cases of barotrauma occurred. (Parenthetically, however, one must remember that only a “few” would be needed to alter the statistics significantly).

Of greater importance is the comparison of this series with others reported previously. In few instances has such a concerted effort been made to establish direct cause-effect relationships between mechanical ventilation and PEEP-CPAP and barotrauma. Rather, overall incidences that were temporally related not only to these forms of therapy, but also to trauma, central catheter placement, tracheostomy, necrotizing pneumonia, etc., have been reported. There is no question that the failure to attempt to define specific causes in these investigations is a significant shortcoming not present in the report by Cullen and Caldera. Nevertheless, when one takes all instances of barotrauma in the present report (22 patients of 200 studied), the incidence of 11 per cent is comparable to the 10 to 20 per cent in many other series.

Whether the patients reported by Cullen and Caldera are comparable to those reported by others must also be ascertained. Clearly, they were very sick, as indicated by their TISS Class IV status. The lowest average PaO2 of 240 torr suggests that the ventilatory component of their illness was not so severe as might be expected. Many of these patients may have been treated with mechanical ventilation and PEEP in a prophylactic manner rather than for established severe ventilatory insufficiency. Clearly, the overall level of ventilatory support was less than in some of the series to which reference is made by the authors. Only 30 patients received more than 12 cm H2O PEEP, and the highest value, in three patients, was 20 cm H2O. By contrast, we reported 28 patients in whom the lowest PEEP was 25 cm H2O. Similar observations apply to the work of Downs and Chapman, in which significantly higher PEEP (27 cm H2O) was employed.

One further point that is open to discussion is the
assertion that the baseline incidence of barotrauma of less than 1 per cent helps to establish the safety of volume-cycled ventilators. Only pressure-cycled and volume-cycled ventilators were used; yet the one ventilator mentioned by name was the Engström, which is time-cycled (as are the Emerson, Siemens Servo 900-B, Foregger, and others commonly assumed to be “volume” ventilators). This is not semantic quibbling. The operational characteristics of most time-cycled ventilators, particularly with respect to the delivery of gas flow and pressures, are different from those of most volume-cycled ventilators. Theoretical considerations suggest that barotrauma might be less when time-cycled ventilators are used because the inspiratory flow pattern can be more precisely controlled. If the authors were indeed using time rather than volume-cycled ventilators, the information is of great importance.

This last point ties in with what is most important in this study. What were the circumstances that led to the decrease in observed barotrauma? Their suggestion that the present study included fewer patients with chronic obstructive pulmonary disease than that reported previously from their institution may partially explain those differences. However, their overall patient population does not appear significantly different from those in other surgical intensive care units. This is most disturbing, for it suggests the authors are doing something right and the rest of us are doing something wrong, yet none of us can ascertain what the differences are. Perhaps the greatest value of this study will be to provoke all of us to a reassessment of our therapy. An overall incidence of pulmonary barotrauma of 0.5 per cent is a worthy goal indeed. Whether we can attain it either individually or collectively with prospective, cooperative multicenter studies remains to be seen.

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References

Are Anesthesiologists Experts in Cardiopulmonary Resuscitation?

Five years ago, at the American Society of Anesthesiologists (ASA) Annual Meeting, the late Dr. Thomas K. Burnap organized a workshop session where ASA physician members could be tested in their skills and didactic knowledge of cardiopulmonary resuscitation (CPR). Instructors were asked to pass those physicians whom they believed could adequately sustain life using CPR techniques. Although the data from that testing workshop were never published, it showed that only about 20 per cent of those (admittedly self-selected) participants were able adequately to resuscitate a manikin on first testing.

In this issue, Schwartz, Orkin and Ellison present the findings of a test of knowledge of currently accepted CPR sequences in a group of practicing anesthesiologists.1 Their predictable conclusion that

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