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Mechanical versus Manual Ventilation of the Lungs of Infants in the Operating Room

To the Editor:—Steward's recent editorial¹ concerning managing infants in the operating room is extremely misleading when it states that "in this day of reliable volume-cycled ventilators . . . mechanical ventilation provides very predictable and constant gas exchange."

In most intensive care unit settings at present, the lungs of infants are ventilated with time-cycled pressure-limited ventilators. The tidal volume the infant receives will directly vary with the changes in the patient's compliance.

However, what is often not appreciated is that even with a "volume-cycled ventilator," as may be used by many anesthesiologists in the operating room, the tidal volume the infant receives still varies with any changes in the patient's compliance. This is because the tidal volume delivered by the ventilator flows into both the ventilator circuit and the patient. The relative distribution of the tidal volume between the circuit and the lungs is dependent on their relative compliances. Any change in compliance of the lungs will alter the fraction of the tidal volume delivered to the patient.

In a normal adult where the compliance of the lungs is much larger than that of the circuit, this correction factor is very insignificant. In an infant, especially one with pulmonary disease, the two compliances

may be nearly identical despite the use of special low-compliance tubing and other modifications of the circuit and ventilator. The circuit will then receive a significant amount of the tidal volume.

An infant with significant pulmonary disease in whom compliance of the lung is constantly changing throughout a surgical procedure is very unlikely to receive predictable and constant gas exchange. One might refer to this as the mistaken faith in the "not-so-educated ventilator."

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In Reply:—I do not believe that I suggested that what comes out of any ventilator is necessarily what goes into the infant; I doubt if there are many anesthesiologists who are naive enough to believe this. I did, when considering manual ventilation, refer to the relative size of the compression volume of the anesthesia circuit compared to the small tidal volume to be delivered. This, of course, is still a factor if we replace the hand with a ventilator. Whether to take this latter step was the real question that I posed.

I did say that I believe many of us are relying more and more on mechanical ventilation even for small infants. A volume-cycled ventilator can produce predictable and constant ventilation over long periods of time (cf. manual ventilation), may avoid undesirable major fluctuations in arterial carbon dioxide tension, and leaves our hands free for other duties; in addition, the adequacy of ventilation can be continuously monitored by oximetry and end-tidal carbon dioxide sampling. If there is a change in the level of ventilation (e.g., due to changing compliance), we note this either by our ears or our electronic monitors, and we

make appropriate adjustments to the ventilator or we resume manual ventilation. This, I think, is the way that many of us now conduct the management of our infant patients. Nowhere did I suggest that we should place any increased faith in the ventilator. Rather, on the contrary, I suggested that, when things change, most will still respond by going back to the uneducated hand!

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