Nine persons participated, each using all four types of bag in random order. The bags were connected to a 'Waeo' nonbreathing valve, and thence to a Wright Respirometer. Each person was told to do his or her best for a full minute. The number of squeezes and the total volume of air moved in the minute were recorded. Average tidal volumes were calculated from these data.

The results are recorded in the table. The mean figures for each piece of equipment have been plotted on the graph. This shows how the bags compare both as to rate, tidal volume, and volume delivered in one minute.

One can see that the old Pulmonator gave the highest volume per squeeze, but that the maximal rate was quite slow; this model was also not durable. The neoprene shell type of Pulmonator delivered volumes that are considered too low for acceptance; although its refill time was short, it was so stiff that all subjects complained of severe fatigue within one minute. The new red plastic Pulmonator has both a good tidal volume and a short refill time: it delivered considerably more air per minute than the other models tested. From its construction one would expect it to be durable; it is about half the cost of other complete units. The Ambu bag has a satisfactory tidal volume; but the rate of refill is only barely sufficient. It is easy and comfortable to squeeze.

It would seem that this is the first attempt to define characteristics for this type of resuscitation equipment. It appears to us that the new red plastic Pulmonator bag is superior to the other models tested.

Mean values of tidal volume and rate for the four bags tested. The curves show the minute volumes. (Δ = old model, Pulmonator. ● = neoprene shell, Pulmonator. ▲ = polyvinyl shell, Pulmonator. ○ = Ambu.)

This investigation was supported by research grant H-5439 from the National Heart Institute, P.H.S.

Reference

V-Tube for Manual Assisted Ventilation

W. Forrest Powell, M.D.*

The simplicity of the Ayre's T-tube technique for endotracheal pediatric anesthesia is generally accepted as one of its major advantages.1 Intermittent occlusion of one arm of the T or Y piece during insufflation effectively assists or controls ventilation. However, only limited information regarding pulmonary congestion, hypoventilation, or airway resistance is available while using this method. If a reservoir bag is incorporated to improve the sense of

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touch and appreciate the development of these variables, both hands of the operator are required.

Nonrebreathing valves, allowing easily applied pressure respiration are more sophisticated but slightly more complicated and subject to mechanical failure.

The following introduces a V-tube modification of the Y-tube which readily permits one handed respiratory assistance or control. There is no sacrifice in simplicity. Changes in airway resistance, pulmonary congestion, respiratory pattern, etc., can be promptly interpreted through the tactile sense.

The apparatus is constructed of light weight clear plastic. As can be seen from the illustration, the modifications are the placement of a baffle on the inlet side to minimize rebreathing and the reservoir bag well forward to the attachment site of the exhalation tube. The latter leaves the junction at a sharp angle then bends back parallel to the inlet tube. This allows thumb occlusion during respiratory assistance with the hand that compresses the reservoir bag.

**Summary and Conclusion**

Flow rates employed are from three to six liters per minute, depending on the normal respiratory minute volume. Interference with adequate anesthetic concentration by dilution with room air through the exhalation tube has not been a problem. Repeated measurements of arterial pH and PaO2 have been within normal limits. This tube has been in routine use during endotracheal anesthesia for infants and children for several months and has proven to be simple and efficient.

**References**