A Simple Valve for Maintenance of Positive Airway Pressure during Deliberate Hypotension

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Positive airway pressure is being used as an adjuvant to deliberate hypotension.1,2,3 This report describes a simple valve† that we have been using during induced hypotension to allow maintenance of positive airway pressure between inflations.

Figure 1 shows the components of the valve. The dumbbell-shaped assembly slides inside a chimney in the center of the housing. The valve seat can be visualized inside the housing.

The valve is inserted in the expiratory limb of the anesthesia circuit as shown in figure 2. An O ring provides an airtight seal between the valve and the expiratory outlet of the machine and allows tilting of the valve. With the valve in place, exhalation continues until airway pressure equals the pressure created by the weight of the valve. When the valve is in the upright position (90 degrees) (fig. 2), the highest airway pressure is produced. Tilting the valve decreases the effect of gravity, with reduction of the airway pressure. Placing the valve at 0 degrees nullifies the action of gravity and results in a drop of the expiratory airway pressure to ambient level (fig. 3).

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† The valve is furnished by Mr. Wayne Hay, courtesy of Ohio Medical Products, 1400 E. Washington Ave., Madison, Wisconsin 53701. (It will be available for purchasing in the near future.)

FIG. 1. Components of the valve, showing housing, plastic lid, and dumbbell-shaped weight-loading guide with a replacement disc. Valve seat can be visualized inside the housing.

Positive airway pressure up to a mean level of about 20 cm H₂O, between inflations, can be achieved simply by adjusting the angle of the valve (figs. 3 and 4). However, positive airway pressure in excess of 15 cm H₂O is rarely needed during deliberate hypotension. The airway pressure is measured at a point close to the endotracheal tube. Factors affecting the mean airway pressure produced by the use of the valve include: position of the valve, tidal volume, inflation pressure and duration of exhalation. Use of the valve permits better control of the required level of positive than manual compression of the bag. The airway pressure and arterial blood pressure...
Fig. 2. Valve in the upright position in the expiratory limb of the anesthesia circuit.

Fig. 3. This figure illustrates the changes in airway pressure produced by altering the position of the valve.

Fig. 4. Tracing showing airway pressure changes produced by altering the position of the valve from 0 to 90 degrees during inspiration and exhalation.

The presence of the valve does not interfere with the function of volume-preset ventilators, but it may upset triggering of inspiration when used in conjunction with a Bird respirator. Increasing the mean airway pressure, however, tends to increase the respiratory deadspace. In view of this, high inspired oxygen concentrations and meticulous control of ventilation above levels usually considered adequate are recommended. The use of the valve is also applicable to other situations in which maintenance of positive airway pressure may be required, such as open-chest procedures, pulmonary edema, and obstructive pulmonary disease.

A spring-loaded valve with a similar function has been used to ensure adequate lung expansion during thoracotomies. The utili-
zation of gravity in our present valve construction provides simpler and more predictable function, as well as minimal maintenance.

REFERENCES

An Articulated Stylet for Endotracheal Intubation

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The placement of an endotracheal tube in a patient with limited neck or mandible motion is a long-standing problem in anesthesia. Many of the patients at our hospital come to surgery with cervical arthritis, postcervical fusion, unstable cervical spines, or external fixation devices. All of these conditions limit the hyperextension needed for endotracheal intubation.

In the course of our efforts to facilitate difficult intubation, we have developed a new articulated stylet, in cooperation with the Biomedical Engineering Facility of this institution. It produces acute flexion of the distal tip of an overriding endotracheal tube, and permits easier placement of the tube during blind or semiblind intubations when the larynx is in an abnormal position. The stylet was designed to provide at will approximately 90 degrees of flexion at the distal end of an endotracheal anode tube. A light was incorporated distally to illuminate the work area. The maximum diameter of the stylet was kept to a minimum to insure that it would function inside a Number 30 endotracheal anode tube.

The instrument consists of a two-inch length of prosthetic cable housing silver-soldered to the distal end of a 10½-inch piece of prosthetic cable-housing (Fig. 1). A lever formed from a ½-inch-diameter disc is silver-soldered ½-inch from the distal end of the two-inch section of cable housing (Fig. 2). A prosthetic cable is inserted through the 10½-inch-long cable housing. The distal end of this prosthetic cable is attached to the disc lever and the proximal end is attached to the trigger. When the trigger is pulled, the prosthetic cable transmits force to the disc lever which provides sufficient leverage to flex the distal