CURRENT COMMENT AND CASE REPORTS

CURRENT COMMENT is a section in Anesthesiology in which will appear invited and unsolicited professional and scientific correspondence, abbreviated reports of interesting cases, material of interest to anesthesiologists reprinted from varied sources, brief descriptions of apparatus and appliances, technical suggestions, and short citations of experiences with drugs and methods in anesthesiology. Contributions are urgently solicited. Editorial discretion is reserved in selecting and preparing those published. The author's name or initials will appear with all items included.

A NEW NONREBREATHING VALVE •

Nonrebreathing valves are useful tools in anesthesia. With these valves it is possible to reduce, apart from a few cubic centimeters, mechanical dead space and consequent carbon dioxide accumulation. This is especially important in pediatric and neurosurgical anesthesia.

There now seems, however, to be a trend to extend the use of the nonrebreathing technique in other types of cases. The nonrebreathing technique is the only one which ensures inhalation of the gas mixture in exactly the same percentage composition as it is delivered from the machine. This diminishes the opportunity for the unsuspected inhalation of mixtures dangerously low in oxygen. In addition, it is possible to exploit the anesthetic property of nitrous oxide to a higher extent, because one is able with confidence to administer effectively the highest possible nonhypoxic nitrous oxide concentration. By so doing, the need for supplementation with centrally depressing drugs is diminished and rapid recovery enhanced.

An essential disadvantage of nonrebreathing valves has been that assisted or controlled respiration required the use of both hands simultaneously; one for manipulation of the bag and the other one for the closure of the exhalation part of the valve. For prolonged use, and especially when used under coverings, as in anesthesia for operations on the head, this has proved to be most impractical.

The nonrebreathing valve here presented (fig. 1) can be used like corresponding valves. In addition, the valve includes automatic closure of its exhalation part during controlled or assisted respiration.

The new nonrebreathing valve (fig. 2) consists of a chamber (a) with a gas-inlet channel 1, a gas-outlet channel 2, and a channel for connection with the airways of the patient 3. The inlet and the outlet channels are arranged coaxially. In the chamber, a movable part with a shape very much like a yarn spool (b) is able to close either the inlet or the outlet channel. In its resting position, it is closing the inlet channel, and it is kept in this position by a soft spring (c).

When the pressure and the turbulence are increased in the inlet channel, as it is done by compressing the bag, this movable part will close the outlet channel (d). The applied positive pressure thus cannot leak out of the valve and as a result inflates the lungs. With discontinuance of the positive pressure, the movable part returns to its resting position (e), allowing free expiration.

An additional spring-loaded valve disk is placed in the outlet channel (e). While of no importance during induced positive pressure, it prevents inhalation of air during spontaneous breathing, because the yarn-spool-like part never closes the outlet channel during spontaneous breathing.

Furthermore, an adjustable blow-off valve is placed opposite the connection channel (f), to avoid inflation of the lungs with a pressure higher than that to which it is adjusted.

The nonrebreathing valve is manufactured in colorless material, so that it is possible to check its function. After a little experience with it, it is also possible
to do this from the feeling of the bag during inflation, or from the sound of the moving parts of the valve, which is clearly audible because no rubber is used in the valve. The outside and the inside of the channels are adapted in size to the size of connections in common use. The connection channel thus can be used with a mask as well as an endotracheal catheter connection. Because of the general adaptability of the nonrebreathing valve, it is also possible to use it as a directional valve. This permits the assembling of an impromptu circle system from equipment commonly at hand. Figure 3 shows one of the possible arrangements for this purpose. With such an arrangement the canister and the bag are independent of the machine, which allows the machine to be placed a convenient distance from the field of operation. The corresponding nonrebreathing set-up is seen in figure 4.

The dead space of the nonrebreathing valve is 9 cubic centimeters. The resistance at a flow of 25 liters per minute is 0.8 cm. of water pressure during inspiration and 1.0 cm. of water pressure during expiration. When used for resuscitation, the disk in the outlet channel, as mentioned, is of no use. Without it in place (fig. 2, c), the expiratory resistance is 0.

Though avoiding any significant amount of rebreathing, depressed respiration still may interfere with the elimination of carbon dioxide. The use of this nonrebreathing valve helps to avoid this and also to control the effectiveness of controlled or assisted respiration. This is brought about because the control of the respiratory minute volume is extremely easy with this valve. If it is decided to give a patient a respiratory minute volume of 10 liters, then this can be accomplished by administering a total flow of gases from the machine of 10 liters—for example, 8 liters of nitrous oxide and 2 liters of oxygen per minute. (Here, as always, the proper way of using the valve includes never allowing the bag to get distended by the gas.)
Any time during anesthesia or after its discontinuation, the efficiency of the spontaneous respiration can be estimated by the use of the nonrebreathing valve. This is done in the following manner: the total gas flow from the machine is so adjusted that the bag keeps a constant average size at the end of expiration. If the total flow of gases from the machine when this is attained is 8 liters per minute, then the respiratory minute volume will be 8 liters. (A decrease in the size of the bag means that the respiratory minute volume is greater than 8 liters, and an increase in the size means that it is smaller.)

The nonrebreathing valve here described has now been in general use for about 3 years, for children as well as for adults, including thoracic anesthesia. Furthermore, it has been used successfully for artificial respiration in patients with respiratory paralysis, and for this purpose frequently has been in continuous use for several days. (The valve, which is made of plastic [perspex®], can be cleaned mechanically by flushing the channels with soap and water. Furthermore, it tolerates most chemicals, including solutions of formaldehyde, ether, and alcohol. As the material deteriorates if exposed to chloroform or heat, these should not be used as aids for cleaning.)

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AN ELECTRONIC PULSE DETECTOR

For many years, we have felt the need for continuous observation of the pulse rate. Present day methods of anesthesia, with all its complexities and manipulations, often precludes palpation of the pulse during periods of greatest danger. The performance of intrathoracic, intracardiac, and other major surgical procedures requires that the anesthesiologist perform many functions at the same time.