A New Pediatric Circle Valve

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Zechman, Orr and Brooks [1] have designed a two-way respiratory valve with excellent static and dynamic air-flow characteristics. Pressure drops 2 mm. H_2O at a flow of 15 l./minute and 6 mm. H_2O at 30 l./minute. During quiet breathing in the dog, the pressure change is 5 mm. H_2O at peak inspiratory and expiratory flows of 18 l./minute. The pressure and flow recordings indicate a negligible valve-opening pressure and an effective valve action, with low damping of the inspiratory and expiratory flow patterns. The leaflet is made of Dow Corning No. 372 film (Silastic), 0.2 mm. thick, and the valve seat is of Teflon with an open cross-sectional area of 119 sq. mm. The deadspace, however, is 8.5 ml., too large for use in premature infants, whose tidal volumes are in the range of 5–15 ml.[2]

We have designed a valve ‡ with a deadspace of 0.5 ml., using the Zechman, Orr and Brooks leaflet and valve seat unit (fig. 1). The valve body is made from a standard mask–endotracheal tube adapter modified by adding a concentric 8.5 mm. tube to divide inspiratory and expiratory pathways. When an endotracheal tube fitting is used with the valve, the 8.5 mm. tube divides the inspiratory and expiratory pathways into approximately equal cross-sectional areas. These are the smallest areas of the valve, and it is this that determines the upper limit of size of patient in which the valve can be used. Since an 8-mm. endotracheal tube commonly is used for a medium-sized woman, the valve is suitable for essentially all children. The lower limit is fixed by the deadspace (provided flow characteristics are satisfactory). A deadspace of 0.5 ml. is only 5–10 per cent of the tidal volume of a small premature infant. Furthermore, if an endotracheal tube is used, the valve reduces the deadspace of the endotracheal tube fitting from 2 ml. to 0.5 ml.

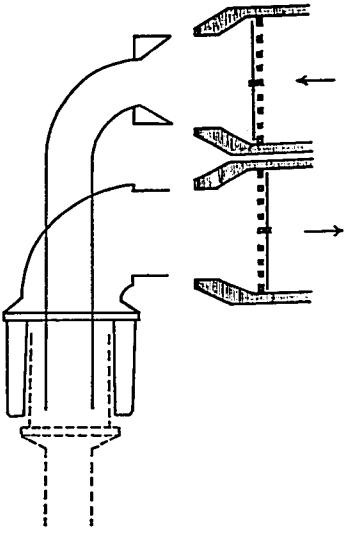

FIG. 1. Columbia Pediatric Circle Valve.

The flow characteristics of the entire valve (modified elbow, leaflet and valve seat) are similar to those reported by Zechman *et al.*, *i.e.*, a pressure drop of less than 1 cm. H_2O at 15 l./minute of air. At the peak air velocity of a full-term infant breathing quietly (in-

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‡ The Columbia Pediatric Circle Valve, manufactured by Anesthesia Associates, Inc., Hudson, N. Y.

spiration, 3 l./minute; expiration, 2½ l./minute) the resistance of the valve is negligible.

We have combined the valve with a single canister (taken from an adult Roswell–Park double canister) to make a pediatric circle system.§ This canister (filled with Baralyme 4–8 mesh) with the breathing hose (19 mm. diameter, 70 cm. long) has a pressure drop of 1 mm. H_2O at a flow of 20 l./minute of oxygen. Similar resistances have been reported for other adult canisters.[3, 4] A spring-loaded pop-off is placed just distal to the expiratory valve seat. The tapers on the inspiratory and expiratory valve units are not the same. Thus, it is impossible to attach directly two inspiratory or two expiratory units instead of one of each (fig. 1). The circle has been used satisfactorily in several thousand pediatric anesthesia cases in patients ranging in size from small premature newborns to children 12 years of age.[5]

§ Anesthesia Associates, Inc., Hudson, N. Y.

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The Effects of Fentanyl and Droperidol, Alone and in Combination, on Pain Thresholds in Human Volunteers

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The advantages of neuroleptanalgesia and the pharmacologic effects of the drugs used to produce this state have been reported widely.[1–4] The drugs most commonly used for this purpose in the United States are droperidol, a potent ataractic, and fentanyl, a potent narcotic, combined (Innovar®) in a fixed 50-to-one ratio. It has been reported that droperidol markedly potentiates the analgesic effects of narcotics in both man [1] and animal.[3] To demonstrate this potentiation, we decided to measure algesimetric responses to fentanyl, droperidol, a droperidol-and-fentanyl mixture, and a saline placebo.

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METHOD AND MATERIALS

Eight female and six male volunteers between the ages of 20 and 35 served as subjects. Studies were conducted on a double-blind basis. All drugs and the saline placebos were injected intravenously in a total volume of 10 cc. over a period of two minutes. The end of the injection was designated zero time. An earlobe algesimeter was used to determine pain threshold, using a technique previously described[6]. After pre-drug control determinations of pain thresholds were obtained, each of six subjects (Group I) received 0.0015 mg. per kg. fentanyl, 0.075 mg. per kg. droperidol, a combination of these two drugs and a saline placebo, at intervals of not less than one week. Pain thresholds were determined at five-minute intervals for 30 minutes and at ten-minute in-