Controlled Ventilation in the Newborn

EDWIN S. MUNSON, M.D., AND EDMOND I. EGER, II, M.D.*

Drs. Munson and Eger have described a unique modification of Ayre's T-piece for controlled ventilation in the intubated or tracheotomized newborn. Figure 1 is a photograph of the entire arrangement. The endotracheal catheter is connected to the proximal arm of a Deaver 24F latex T-tube (A). This tube, ordinarily used for biliary drainage, has the advantage of flexibility, lightness, and ease of adaptation to other components of the system. A (Puritan) nebulizer (B) with a pressure compensated flowmeter delivers a constant stream of humidified oxygen (fog) at a flow of 6-8 LPM. The delivery hose from the nebulizer is attached to the distal arm of the T-tube (C). Expired and over-flow gases escape through the stem of the T-tube (D). This is connected by flexible tubing (E) to the exhalation valve assembly of a Bird respirator. The flexible tubing serves as a reservoir for humidified gas. The respirator itself (F) is connected to the exhalation valve by a further length of flexible tubing. The lengths of flexible tubing permit placement of the individual components away from the patient's airway and thus allow convenient access to the patient.

Mean airway pressures are related to the flow rate of delivered oxygen, the respiratory rate, and the settings of the flow rate and pressure controls on the respirator. Airway pressure can be readily monitored and adjusted with the Bird retardation valve to produce elevated end-expired pressures if desired. Peak airway pressure is limited by the peak pressure attained by the respirator. This is in contrast to the pressures attainable when controlled ventilation with the T-piece is produced by occluding ("thumbling") the outlet from the T. In this case, the upper limit is the line pressure which may equal several atmospheres.

Figure 2 is a diagram of the system during inspiration. Pressure produced by the respirator reverses the outflow of fresh gas from the T-tube stem and flexible tubing. Gas from this tubing plus gas from the nebulizer inflates the lungs. The proportion of gas from each source is dependent on flow from the nebulizer, pressure achieved by the respirator, compliance of the lungs, and resistance to flow in the various tubes. In any case, the patient is ventilated only with humidified gas either from the nebulizer or from the flexible tubing (reservoir) connecting the T-piece to the exhalation valve assembly. Rebreathing is prevented by maintaining nebulizer flows above three times the minute volume ventilation of the infant. Gas from the respirator does not reach the patient. The respirator serves only as a pressure source. Although a Bird respirator is used in this arrangement, any pressure-limited respirator might be used provided it possessed an adequate range of pressure, rate, and inspiratory-expiratory phase.

* Department of Anesthesia, University of California Medical Center, San Francisco.

Fig. 1. Arrangement for a modification of Ayre's T-piece for controlled ventilation in the intubated or tracheotomized newborn.
adjustment. Figure 3 shows the system during expiration. With the exhalation valve open, expired gas from the patient is cleared from the system by the continuous high flow of fresh gas. This prevents rebreathing and insures that dry gas from the respirator does not reach the patient on the subsequent inspiratory phase.

This system makes use of familiar equipment to provide a simple apparatus for efficient ventilation in the newborn infant. It insures well-humidified oxygen at adequate flow rates and cycles per minute, minimal dead space and resistance, readily controllable airway pressures, and minimal equipment near the patient.

Supported in part by USPHS Grant 5-K3-GM-17, 685-02.

Pneumatic Monitor for Arterial Blood Pressure

B. Raymond Fink, M.B.*

Dr. Fink notes that arterial blood pressure measurements, though vital to the safety of many anesthetized patients, are seldom available continuously, mainly because the necessary instruments are too costly. Because of its simplicity, reliance continues to be placed on the sphygmomanometer, although its readings are at best intermittent, and at worst difficult or impossible to obtain in a crisis. It seems inescapable that for secure, uninterrupted observation of blood pressure, measurements must be made directly through an arterial cannula. Techniques of transeptaneous arterial puncture have been available for years, but have remained of limited clinical application because they require electrical transducers and amplifiers. Coupling the artery to a mercury or aneroid manometer has been suggested, but this yields only the mean arterial pressure and is plagued by clot and the possibility of false high readings.

The need for a simple, direct method of monitoring arterial pressure remains, a need to which the system described here is offered as a working answer. Comprising an air or "pneumatic" manometer connected to a teflon arterial cannula and maintained patent by a trickle of saline, it allows indefinitely continued measurement of systolic and diastolic pressures and serves at the same time as a monitor of the cardiac rhythm. A kindred device suitable only for brief observation has been developed independently by De Bono.

Arterial Cannulation

The cannula consists of a tapered two-and-a-half inch, 18-gauge (for adults) or 20-gauge (for children) teflon catheter with Luer hub...