length) is attached with adhesive tape to the neck of a rebreathing bag. The longer piece is fitted to a rigid nylon, serrated Y connector (model 3520, Sterilon Corp.), in turn inserted in the tail of the bag. The other arm of the Y connector is sealed with a short piece of amber rubber (tourniquet) tubing and a screw clamp. Because the valve is not sensitive to gravity, the bag may be mounted equally well on the anesthesia machine or at the end of a breathing tube, as in the Jackson-Rees modification of Ayre's T piece. Figure 1*B* shows a design simpler to construct, but more subject to kinking. The materials are the nylon Y connector, amber rubber tubing and clamp, and a longer length of small (½") or medium (⅝") Penrose drain; the latter is stretched over the Y connector at one end, and trimmed to just reach the neck of the rebreathing bag, where it is attached with adhesive tape, without slack or undue tension. Some care is required in suspending the Penrose drain over the bag. The version shown in Figure 1*C* requires a special adapter,§ but takes advantage of gravity to protect the Penrose drain from kinking. A 10- or 12-inch length of small (½") Penrose drain, force-fitted over the side arm of the adapter, completes the assembly). This design is suitable only for mounting on an anesthesia machine. With each of the three designs, the overflow pressure within the breathing system is less than 1 cm H_2O at a gas inflow rate of 5 l/min.

§ Adapter manufactured by Ohio Medical Products and made available to us through the courtesy of Mr. Wayne May.

The advantages of this design over other semiautomatic pressure-relief systems for use during artificial respiration include:

1) It is inexpensive and may be modified or adapted to individual needs.
2) It can be attached to any anesthesia machine or breathing circuit, e.g., to-and-fro, nonrebreathing.
3) It cannot lock closed at any pressure, which can occur with other automatic pressure-relief valves.
4) This principle permits only two functions, "on" and "off." Either it is engaged and flow is interrupted, or it is not engaged and vents freely. Constant readjustment to accommodate changes of gas flow and type of ventilation is unnecessary.

Problems encountered during development included:

1) The Penrose drain tended to kink if too long or suspended too loosely. Designs *B* and *C* (see figure) were most susceptible to this fault.
2) Moisture collecting in the Penrose drain tends to make the drain sticky. Frequent replacement of the drain avoids this problem.

We believe that instructors in training institutions will appreciate the decreased incidence of overdistention of the breathing bag, and patients' lungs, which result from use of this valve.

CASE REPORT

Cardiac Arrest during IPPV in a Newborn with Tracheoesophageal Fistula

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Esophageal atresia with tracheoesophageal fistula presents a major anesthetic risk because anesthetic gases can escape into the gastrointestinal tract during intermittent positive-pressure ventilation (IPPV). This causes gaseous distention of the stomach and may result in an acute rise of intraabdominal pressure which can be complicated by serious circulatory embarrassment and even cardiac arrest. The purpose of this report is to illustrate

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the value of gastrostomy in the initial management of this malformation to prevent such a complication.

Report of a Case

A male baby was born after a full-term pregnancy and an uncomplicated delivery. Birth weight was 3,300 g. Excessive secretions in the oral cavity were noted after birth, and were increased by feeding dextrose in water. The infant was admitted to the American University Hospital 24 hours after birth with respiratory distress. An attempt at nasogastric intubation failed. Esophageal atresia with tracheoesophageal fistula was confirmed radiologically.

The baby was scheduled for surgical repair of the anomaly on the day of admission. Premedication was limited to atropine, 0.15 mg. injected intramuscularly 30 minutes before anesthesia. With the infant awake, the trachea was intubated with a Cole tube (size 14 French). He was then allowed to breathe 1 per cent halothane in oxygen spontaneously, using a modified T-piece semiopen circuit.[2] Cardiac activity was monitored continuously with an oscilloscope. Cardiac rhythm was regular at a rate of 140/min. As soon as IPPV was started, the abdomen became distended and very tense. EKG showed bradycardia, which rapidly progressed to asystole. External cardiac compression and ventilation with 100 per cent oxygen restored sinus rhythm. The baby, however, remained pale, with a tense abdomen. A gastrostomy was done rapidly through a vertical supraumbilical incision and a size 14 French mushroom catheter was left in the stomach, which immediately became decompressed. This was associated with considerable improvement in the general condition of the baby. Recovery was uneventful.

After adequate preparation for ten days, the baby was scheduled for definitive repair of the esophageal malformation via a right thoracotomy. The previous anesthetic technique was used and the gastrostomy tube was left open as a vent during induction and maintenance of anesthesia. IPPV with 1 per cent halothane in oxygen did not produce any electrocardiographic changes or cardiovascular embarrassment throughout the procedure. The patient left the operating room in good condition.

Discussion

Intermittent positive-pressure ventilation is indicated during the definitive repair of tracheoesophageal fistula.[3] Anesthetic gases can inflate not only the lungs, but also the gastrointestinal tract, and can result in severe abdominal distention associated with a marked increase in intraabdominal pressure. These changes may splint the diaphragm and compress the inferior vena cava, producing both respiratory and circulatory embarrassment. If venous return is markedly impeded, it can terminate in cardiac arrest.

The hazards of positive-pressure ventilation in neonates who have esophageal atresia associated with tracheoesophageal fistula must be kept in mind. An initial gastrostomy under local anesthesia will help to prepare critically-ill or premature babies for definitive surgery[4,5] and has been advocated as routine for all newborns who have distal tracheoesophageal fistula.[5,6] Gastrostomy serves for gastric decompression, allows safe IPPV during the repair, and reduces the risk of regurgitation of the acidic gastric contents into the lungs. The importance of leaving the gastrostomy tube open as a vent during induction and maintenance of general anesthesia for definitive repair to prevent distention of the gastrointestinal tract is stressed.[7]

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