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.

PNEUMATIC BALANCE RESPIRATOR

The pneumatic balance respirator which was developed during the last war by Henry L. Burns was given its original clinical trials by Motley, working at Wright Field Aero Laboratory. Since the war it has been produced commercially and is now known as the Pneophore. This instrument is used by fire departments as a respirator and by some hospitals in their emergency rooms or for cases of apnea from any cause. Because this respirator is being used more widely, the following cases and some potential difficulties in the use of the machine are reported.

Recently 2 cases of apnea in children have occurred in this hospital.

Case 1.—A 5 year old boy was brought to the hospital in respiratory failure from an extradural hematoma. One hour had elapsed since respiratory difficulties had begun until he reached the operating room (still under a conventional positive-negative pressure respirator). It was thought that intracranial pressure sufficient to depress the respiratory center for so long a time probably precluded complete recovery. Craniotomy was done and a clot was removed within twenty minutes of the patient's arrival in surgery. Twenty minutes later he began to breathe spontaneously. An endotracheal tube was left in place and a pneumatic balance respirator left in the room to be attached if respirations ceased. Two hours later respirations ceased and the respirator was connected. A cycle was not established but the respirator did not "chatter" as though there were any obstruction. Hand breathing by means of a bag, and a to-and-fro absorber was instituted for oxygen administration. Attempts to make the machine operate properly were unsuccessful. Another machine sent by the company was equally ineffectual although the endotracheal tube was changed and suctioned and all connections were completely checked. When each machine was attached to a small bag to simulate a child's lung, a cycle was established. It was finally decided to desist from any further attempts to use the machine. Respirations were maintained by means of the bag until the child's death.

Case 2.—A 5 year old child had an extensive resection for a craniopharyngioma. Edema of the brain stem sufficient to cause respiratory failure developed. The pneumatic balance respirator was attached and again it did not "chatter" but did not function properly. A sound of continuous exhaust, similar to that of the expiratory phase (without continuing to the inspiratory phase) was present. In an attempt to determine the cause for failure of the machine to operate properly, I inserted a short piece of corrugated anesthesia tubing between the endotracheal tube and the respirator. An occasional complete cycle was established. Complete success was achieved when a small bag was placed in either series with the respirator and endotracheal tube or on a T attached to both. The machine operated with perfect regularity, and breath sounds could be heard throughout the chest. On this arrangement respirations were maintained automatically for a week with no further difficulties from the machine.

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In order to avoid further difficulties, the engineer who had originally designed the pneumatic balance respirator was consulted. He thought that probably the difficulty arose because of the extremely sensitive mechanism of the balance. In instances in which such small volumes were involved, the masking or dampening of this sensitivity (provided by the BLB bag) permitted a complete cycle to be established.

This difficulty and a method of obviating it is brought to the attention of other anesthesiologists who may be confronted by a similar problem.

ANTON C. KIRCHHOFF, M.D.,
Providence Hospital,
Portland, Ore.

PATTERNS OF RESPIRATION IN THE NEWBORN
A SUGGESTION FOR THE TRAINING OF RESIDENTS

To anesthetize infants with some degree of confidence, the anesthesiologist needs to learn the many and variable breathing mechanisms common to this age. A training program in anesthesia should afford many opportunities for examination of newborn infants in order to become familiar with the diverse respiratory patterns characterizing normal full-term newborn infants, premature infants, infants with drug depression, infants with cerebral injuries or other abnormalities. Their multiple and variable modes of respiration can easily lead one astray in determining depth of anesthesia or efficiency of respiration. For example, it is common for premature infants or infants under the influence of sedatives to breathe principally with their diaphragm, the chest wall going inward with each inspiration as is seen in deep planes of surgical anesthesia. The recognition of this respiratory pattern before administering an anesthetic will avoid the error of concluding that the infant is in deep surgical anesthesia when it is actually scarcely asleep.

For the purpose of acquiring more knowledge of infant physiology, newborn infants in the nursery of MacNeal Memorial Hospital were inspected daily for patterns of respiration, observing which of the muscles of respiration were in action at the time of birth and during the week or longer of residence in the nursery. A total of 154 infants was examined in a thirty-day period. Of these, 149 were full-term infants, or weighed more than 5 pounds. In infants weighing over 5 pounds, both the diaphragm and the intercostal muscles usually functioned well at birth, but the onset of intercostal elevation of the chest wall occurs about one-half second after the onset of descent of the diaphragm. This split-second lag in time between diaphragm and chest wall movement has been misinterpreted to mean that new born infants are diaphragm breathers exclusively. Full-term newborn infants have an inward depression of the lower two ribs on inspiration, while the upper ten ribs elevate and expand the thoracic cage. This is attributable to the more powerful diaphragm predominating over the upward pull of the less powerful intercostal muscles at the line of attachment of the diaphragm to the costal margin.

In premature infants, or those weighing less than 5 pounds, it was common to encounter two types of respiratory pattern. In one type, intercostal function was absent or infrequent, resulting in a rocking type of respiration similar to deep surgical anesthesia. Sometimes there were periods of good intercostal function, alternating with little or none. If these infants were seen while asleep, and unmolested by the examiner, intercostal function was often absent, but upon handling the infant or causing it to awaken, intercostal function was added to diaphragm movement, and respirations were then performed by both muscle groups. Intercostal muscles may be used by many infants for the forceful expulsion of air associated with crying, the infant reverting to diaphragm motion exclusively when not crying. The administration of an irritant vapor such as ether or vinylthene to an infant breathing with its diaphragm only will frequently elicit the same change in respiratory pattern, that