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Another Cause of a Prolonged Downstroke on the Capnograph

To the Editor:—A prolonged downstroke on the capnograph during mechanical ventilation may be attributed to malfunction of the inspiratory valve, slow ventilation, or a leak *via* chest tube.[1,2] We report an unusual cause of a prolonged downstroke.

A 22-yr-old, 65-kg man underwent elective discectomy of L4/5 for a prolapsed intervertebral disc. The anesthesia machine (Narkomed 4, North American Dräger, Telford, PA) that incorporated a circle carbon dioxide absorber system was checked preoperatively. No leaks were detected. The patient was intubated orally with a size 8.0 cuffed Ring-Adair-Elwyn tube (Mallinkrodt, Athlone, Ireland). The endotracheal tube was connected to a straight-expired gas sampling adapter (Straight T adapter, Datex Instrumentarium, Helsinki, Finland), and this was, in turn, connected to the circle system. The carbon dioxide sampling line attached to the adapter was connected to a built-in infrared side-stream analyzer with a sampling rate of 200 ml/min.

Mechanical ventilation was commenced with a fresh gas flow of 1.5 l/min (900 ml nitrous oxide, 600 ml oxygen, isoflurane, 1%), a tidal volume of 600 ml/min, a rate of 10 breaths/min, and an inspired-to-expired ratio of 1:3. This yielded a peak airway pressure of 22 cm water and an end-tidal pressure of carbon dioxide of 38 mmHg. However, the capnograph trace showed a prolonged downstroke corresponding to a shortened phase III. A check of the circuit revealed a soft hissing sound during inspiration. A crack was then noted on the inner sleeve of the straight adapter (fig. 1). This adapter was used previously and may have cracked as a result of its reuse. Replacement of the straight adapter corrected the abnormal capnograph trace (fig. 2) but had little effect on the other parameters (tidal volume, 610 ml; peak pressure, 23 cm water: end-tidal pressure of carbon dioxide, unchanged).

The patient-end of the straight adapter can be used either as a male port for attachment of a face mask or as a female port for attachment of a endotracheal tube. To facilitate this, the straight adapter was designed with 15-mm inner sleeves and 22-mm outer sleeves, without obliterating the space in between. If there is a fracture of the inner sleeve, as in our case, entrainment of air into the circuit or leak of gases from the circuit may occur through the space between the sleeves. The dilution of expired carbon dioxide with entrained air produced the shortened phase III on the capnograph. Entrainment of air resulted from the continuous aspiration of the side-stream analyzer, because the use of a mainstream carbon dioxide analyzer does not reproduce the trace. This dilution, together with superimposed small tidal volumes from cardiac activity, also produced cardiogenic oscillations. These oscillations were readily observed because of the use of a low respiratory rate and an inspired-to-expired ratio of 1:3.[3] In addition, a small leak occurred when peak inspiratory pressure was reached, producing the hissing sound.

This leak would not be detected with established anesthetic circuit checkout[4] because both sleeves of the adapter would be occluded when the patient port is occluded, either by hand or with a test lung. A breakage of the inner sleeve in a similarly designed Y-connector has

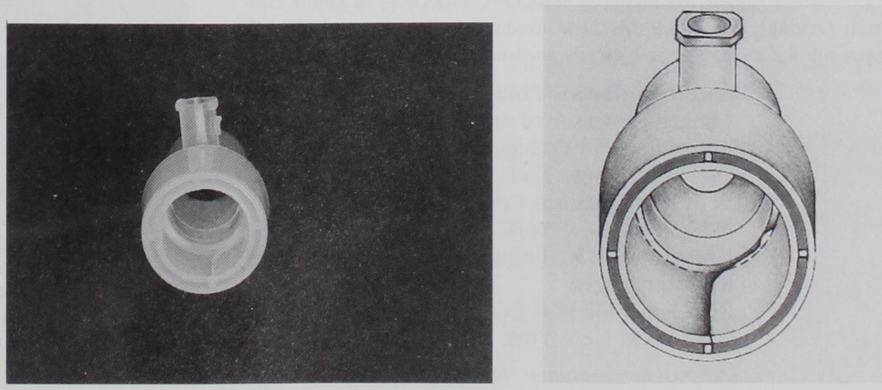

Fig. 1. Photograph (*left*) and artist's rendition (*right*) showing a crack in the inner sleeve of the straight adapter extending from the patient-end inward and to the right.

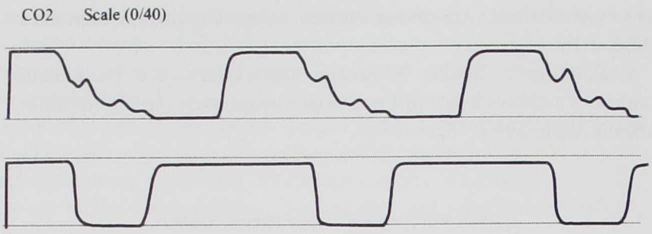

Fig. 2. Capnograph traces with the cracked straight adapter (*top*) and after replacement with an intact straight adapter (*bottom*).

been reported.[5] A careful visual inspection of adapters of this design should therefore be incorporated into routine preanesthetic checkout.

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Create a Party Mood for a Smooth Anesthetic Induction of Children

To the Editor:—Anesthetic induction in some children in the 3–7-yr age group still remains a challenge. Not surprisingly, most unpremedicated children become apprehensive and reluctant to cooperate in the unfamiliar environment of an operating room. Some children become frightened when the anesthetic circuit is brought close to their face. The painless intravenous line (emulsion mixture of lidocaine and prilocaine, EMLA cream; Astra, Westborough, MA), the flavored mask, the odorless anesthetic gas, the stuffed animals, the pacifiers, and parental presence all have been used in an attempt to comfort the child and ease induction.

Currently available pediatric circuits are plain and uninteresting to a child. We modified the circuits, for induction of anesthesia, with cheap, readily available party favors. Mapleson-D or the pediatric Circle system both can be modified, as shown in figure 1. The children were coaxed easily into using these circuits and were willing to play the game. They were distracted by the toy attached to the circuit and were indifferent to the anesthetic gases that were being administered by this device. While using the toys, the children wanted to blow hard and fast. Therefore, they inspired the anesthetic gases up to the limit of their vital capacity. This increased minute ventilation and hastened induction in smaller children. After the child was asleep, the circuit was reassembled conventionally to continue administration of the anesthetics.

The scavenging system was not used in the initial induction period and may increase the spillage of the anesthetic gases into the operating room. Also, replacing the reservoir bag with the party favors may necessitate a higher gas flow for induction, especially in larger children. Overall, we found this new modification to be yet another approach for a pleasant and speedy anesthetic induction for children.

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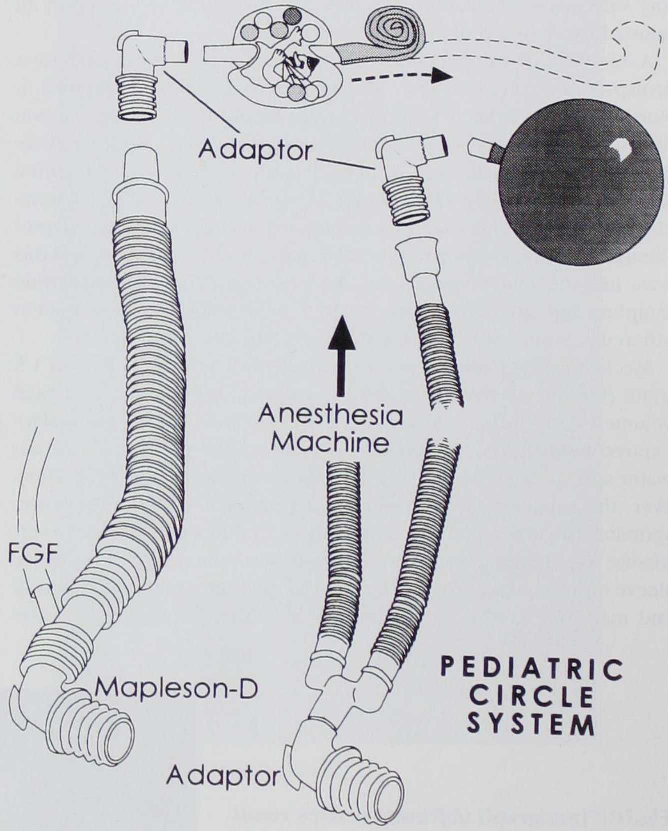

Fig. 1. The two pediatric circuits, Mapleson-D and the pediatric Circle system, with the party favors assembled. An extra circuit adapter connects the party favors to the circuits. In the Mapleson-D circuit, the party favors replace the breathing bag. In the pediatric Circle system, the expiratory limb of the circuit is disconnected from the anesthetic machine, and the party favor is attached to that end.