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End-tidal Carbon Dioxide Monitoring May Help Diagnosis of H-Type Tracheoesophageal Fistula

To the Editor:—End-tidal carbon dioxide (ET_{CO^2}) monitoring can be used to detect air embolism, circuit disconnection, endotracheal tube kinking, and rebreathing.[1] Recently, capnography assisted in the diagnosis of a tracheoesophageal fistula.

A 1-month-old, 3.2-kg infant was admitted with a diagnosis of gastroesophageal reflux. Increased temperature, respiratory rate, and leukocyte count and choking and brief cyanotic spells after feeding suggested aspiration pneumonia. Medical history included uncorrected cleft lip and palate and patent ductus arteriosus, patent foramen ovale, bilateral SVC, and right atrial and ventricular enlargement.

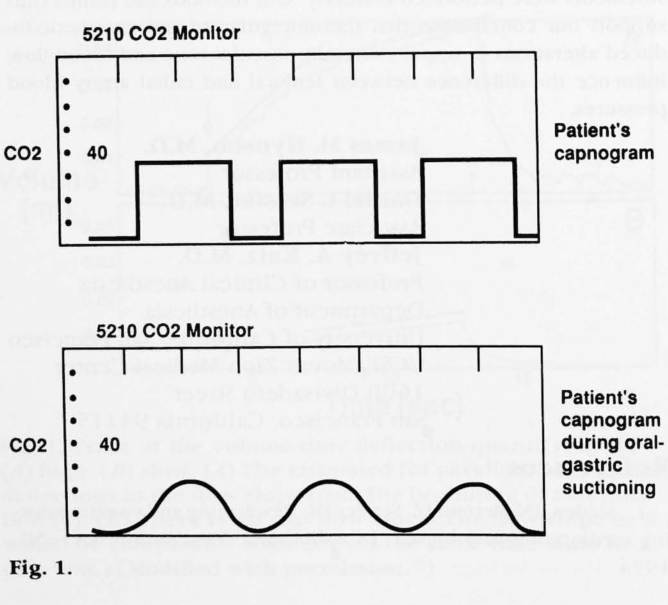

Fig. 1.

The infant was brought to the operating room for a Nissen fundoplication. Rapid sequence induction and intubation were done without positive-pressure ventilation by mask. Ventilation was begun *via* a 3.0 oral endotracheal tube, secured with the tip 9 cm at the alveolar ridge.

A central venous catheter was inserted. A chest x-ray showed the tip of the endotracheal tube to be midway between clavicles and carina. The incision was made, and after entering the abdomen, the surgeon noted air in the stomach. An oral-gastric suction catheter (position confirmed by surgeon) briefly emptied the stomach, but the stomach would refill. Ventilation peak pressure was reduced to 15 cmH_2O out of concern that air leaked around the endotracheal tube, accumulated in the pharynx, and then moved down the esophagus into the stomach.

It was then noted that, when the oral-gastric tube was suctioned, the previously square ET_{CO^2} capnogram waveform changed to a reduced, rounded form (fig. 1). A presumption of tracheoesophageal fistula was made. This was confirmed by bronchoscopy and esophagoscopy, which showed an H-type connection about halfway between the anterior esophagus and posterior trachea.

We assumed that suctioning the oral-gastric tube drew air from the lungs, *via* the tracheoesophageal fistula, into the esophagus and stomach. The result was a reduction of expired carbon dioxide, shown by the changed ET_{CO^2} capnogram. Gastric dilitation may have been caused by inspiratory pressure and/or partial intubation of the fistula itself.[2]

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Reply from Compressed Gas Association, Inc.

To the Editor:—We share the concern of Greilich *et al.* about the incident but must weigh the potential impact of any changes to connection assignments very carefully. Although it is possible to effect a change to the standards, the impact on existing users can be significant and create other problems that are not immediately apparent. In addition, the transition period can create situations that impair the user's ability to connect the gases to their systems and compromise the patient until the appropriate connection can be obtained. We therefore must determine the various uses of the gases and establish an appropriate plan to address every situation that we can predict.

The Compressed Gas Association is an organization that has safety as its foremost objective. Our use of connection standards has been a key element of our efforts to improve safety in the industry for users and for manufacturers. The success of the system has been very rewarding but, unfortunately, cannot address all potential conditions. For that reason, we have always stressed the importance of proper use of labeling and marking as the first means of identification of gases. We also strongly advise that any container that cannot be connected to the intended use device or whose labelling or marking is illegible or incomplete be returned to the supplier for identification. In the medical portion of the industry, color marking standards typically are used in addition to the written identification of the gas. The reliance on labelling and color marking combined with the noninterchangeability of connections maximizes the protection of the user and the patient. Failing to read the label, ignoring the color markings, or defeating the noninterchangeability features can result in failure of the system.

Because of the need to assess the impact of any proposed changes, we cannot commit to a particular solution at this time. The important message is that the connection assignments are one part of a larger system that has served the users well over the years. Reliance on any one part of the system to the exclusion of the other parts can significantly compromise the system.

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This letter is in response to a Case Report. Please see: Greilich PE, Greilich NB, Froelich EG: Intraabdominal Fire during Laparoscopic Cholecystectomy. ANESTHESIOLOGY 83:871, 1995.