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A Cost-Free, Simple Method for Monitoring End Tidal Carbon Dioxide through Nasal Cannulae

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The national standards of care to which we are all held are beginning to include pulse oximetry and more recently capnographic monitoring. Indeed, for a patient who is receiving supplemental oxygen, capnography may provide an earlier warning system of respiratory impairment than pulse oximetry. In minutes a patient's PO_2 may deteriorate from several hundred torr to near 100 torr without any change in the pulse oximeter. As a disaster is developing the oximeter benignly continues to register an oxygen saturation of 100.

During this time of obstruction or respiratory arrest, capnography monitoring registers early the decrease in ventilation. With capnography early measures to correct the underlying problem can be instituted; treating obstruction of the airway instead of hypoxia. There are available compact instruments that combine pulse oximetry and end tidal carbon dioxide monitoring in the same machine. Routine monitoring of both parameters assesses the adequacy of ventilation and tissue oxygenation, changes in which usually precede an office disaster for a sedated patient. It is a rare hospital operating room that does not monitor as a routine both oximetry and end tidal carbon dioxide for patients undergoing local anesthesia with monitored anesthesia care. This is the standard to which we will be held.

Several ways have been described to monitor end-tidal carbon dioxide in spontaneously breathing patients. One method uses construction of a sampling catheter with a feeding tube and padded foam; the other method, by cannulating one side of a nasal cannula port. The first method requires construction and immobilization of the components.[1] The second method shares the same port with administered oxygen.[2]

In the first case a feeding tube is introduced through a section of foam padding, then the foam with the feeding tube through it, is introduced into one nares. The foam serves as obturator while the feeding tube serves as end tidal carbon dioxide sampling port. Although this method has been reported to be tolerated by most patients, it is clear that for operative procedures in the oral cavity or about the head and neck, that the feeding tube could be dislodged or be so manipulated to cause a nosebleed. Worse yet would be the separation of the components and the loss of the foam pad into the nasal passages.

In the second published method[2] the sampling port is shared with an inspired fresh gas port on the nasal cannula. There is no complete obturation of this port so the sampled end expired gas is diluted. This results in a more damped end tidal carbon dioxide tracing and lower CO_2 numerical values on the road out, i.e., less accurate end tidal CO_2 sampling than with the feeding tube and obturation method.

In an attempt to draw from the advantages of each of these techniques, and to eliminate the major disadvantages inherent in each, another method is presented.

Obturation of one of the fresh gas introducing prongs is preserved, but is done within the prong of the cannula instead of inside the nasal cavity of the patient. The taper of the component parts is away from the patient and the method may be modified for use with any disposable masks, in the operating room or post anesthetic care unit.

The construction and use of this method is easy. The plastic protective tip cover of a disposable syringe is cut with scissors providing a hollow connector (Figure 1). With an eliptical hole cut into the top of a nasal cannula, (Figures 2, 3), the modified syringe tip cover can be screwed to the cannula and the luer-lock $ETCO_2$ sampler locked onto it (Figure 4).

Several improvements over previously described methods include possible greater accuracy, retention of the attachment, no cost, enhanced safety and adaptability.

The end tidal CO_2 tracing derived from an obturated, non-diluted by fresh gas flow, is less damped and reflects higher numerical values than from a port shared with a high flow of fresh gas. It is suggested that these better defined tracings and numerical values approaching 40 torr closer reflect the actual end tidal CO_2 and therefore PCO_2.

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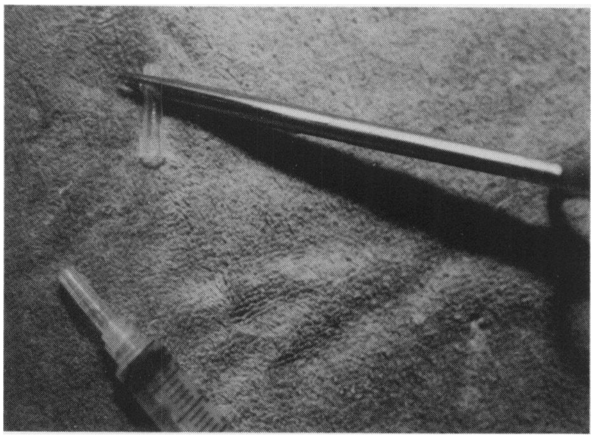


Figure 1. Five ml syringe and tip protector being trimmed for use as adaptor for $ETCO_2$ sampler.

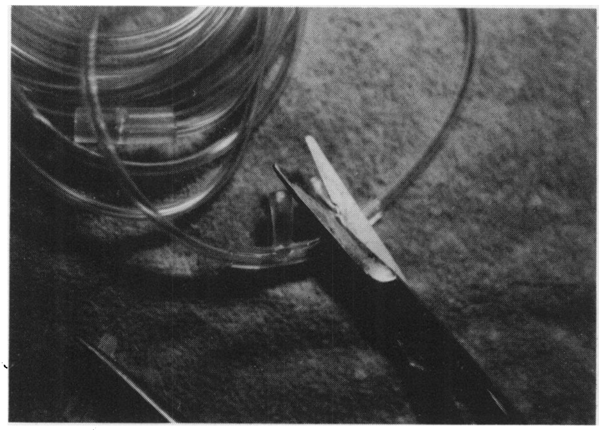
The attachments are luer-locked into place. The device won't kink or be easily dislodged. Taper of the components is away from the patient and obturation is within the prong rather than in the patient's nose.

This arrangement is constructed at virtually no additional cost. The syringe tip cover is normally discarded when a syringe is opened for use. Goldman's[1] technique requires a new over-the-needle catheter be used for each patient. Bonsu's[2] technique calls for a new stomach tube be used for each patient.

This new device is safe. There is no chance for needle mishaps, nosebleed, or lost parts in the nasal cavity of the patient.

This apparatus is adaptable in that it can be used with a face mask designed for single patient use. Although Bonsu's technique probably would result in more precise end tidal carbon dioxide values when used with a face mask, this proposed technique has been

Figure 2. Syringe tip protector and nasal cannula being trimmed for use for end tidal carbon dioxide monitoring.



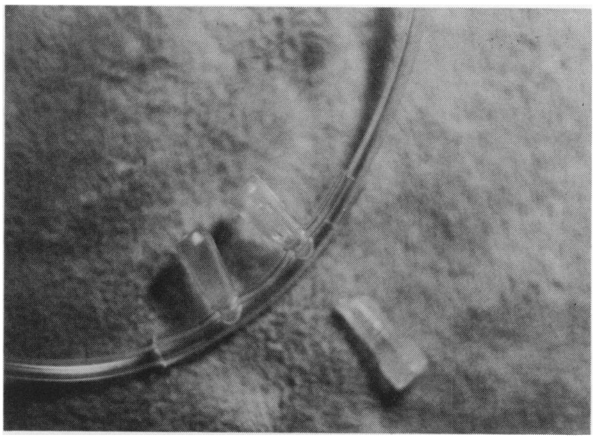


Figure 3. Syringe tip protector and nasal cannula, close up view, direction of connection.

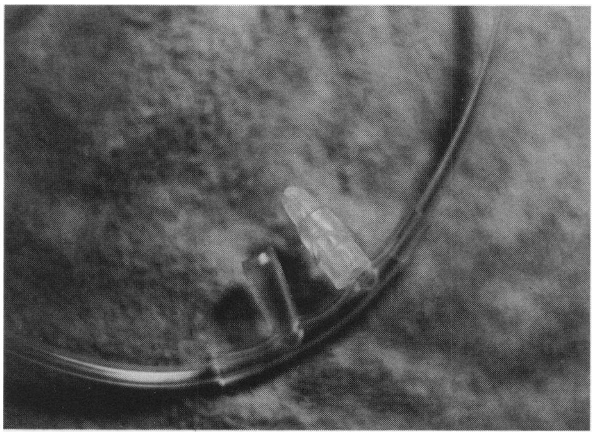
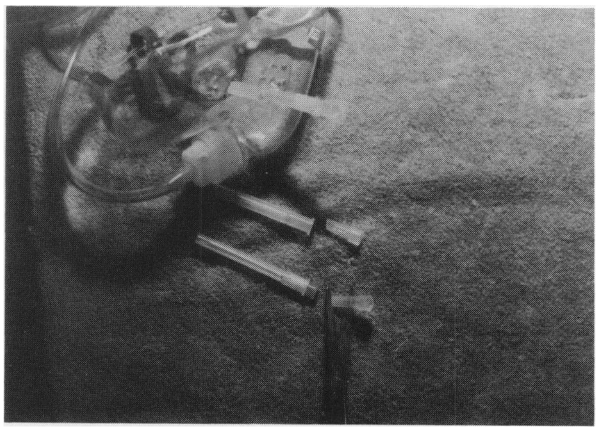


Figure 4. The rear of the syringe tip protector is then joined to the luer-lock of the capnograph sampling tube.

Figure 5. Adaptation of system to disposable single patient use mask. Syringe tip cover cut with scissors, then placed in similarly cut needle cap. This combination then introduced through mask, sampling port near the nose.



used by mask administration with high flow oxygen. A simple mask, partial rebreather and non-rebreathing disposable patient masks have been used the following modification.

As illustrated in Figure 5, the orifice of the sampling port is placed nearer the nose by using a tip-trimmed needle cover with the tip-trimmed syringe cover.

REFERENCES

1. Goldman JM: A simple, easy and inexpensive method for monitoring $ETCO_2$ through nasal cannulae. Anesthesiology 1987;67:606.
2. Bonsu AK: A Nasal Catheter for Monitoring Tidal Carbon Dioxide in Spontaneously Breathing Patients. Anesthesiology 1989;71:318.