Tube-in-Tube Rescue Airway Management for a Perforated Endotracheal Tube by Patient Biting

To the Editor:

I read with great interest the recent case report by Duma et al.1 regarding tube-in-tube emergency airway management after a bitten endotracheal tube (ETT) caused by repetitive transcranial electrical stimulation during spinal cord surgery. This is indeed a favorable rescue airway measure for the ETT perforation by patient biting or electrical surgical instrument,2–4 especially when the ETT exchange is difficult or impossible because of patient position, space limit, device deficiency, and others. The authors stated that this method was a new strategy to manage the ETT rupture during surgery. In fact, Peskin and Sachs2 used a tube-in-tube technique to manage a partially severed nasotracheal tube during orthognathic surgery in 1986. Moreover, in this article, the tube-in-tube study in table 1 gives the best sizes for the inner tubes that correspond to the sizes for the outer tubes. It has been shown that the outer diameter of the ETT for a given internal diameter from different manufacturers varies because of differences in wall thickness.5 Therefore, these results may be only suitable for the ETTs tested by the authors.

Just as the authors have found, a main disadvantage of the tube-in-tube technique is increased resistance to ventilation because of small internal diameter of an inner tube. We had used a modified method to establish emergency airway after a size 7.5-wire-reinforced ETT was perforated by biting in a patient undergoing face and neck scar resection under the lateral position. The destructed wire-reinforced ETT and a size 5.0 cuffed polyvinyl chloride ETT (used as an inner tube) are cut at 0.5–1.0 cm distal to the site of attachment of the external inflation tube of the cuff (figs. 1A and B). The shortened inner tube is adequately lubricated and inserted into the destructed wire-reinforced ETT, and the midpoint of the cuff of the inner tube is located at the damage site of the wire-reinforced ETT (fig. 1C). Subsequently, the cuff of the inner tube is inflated, and the inner tube is connected to the circle breathing system by the standard connector. During the intermittent positive pressure ventilation with a tidal volume of 10 ml/kg, a ventilatory frequency of 10 breaths/min, an inspiratory time-respiratory cycle time ratio of 1:2, and a fresh gas flow of 2.5 l/min, the mean and peak airway pressures observed were 9 cm H2O and 21 cm H2O in this patient.

As compared with methods reported by Duma et al.1 and Peskin and Sachs,2 we consider that this modified technique has some possible advantages. First, removing the tube connector and the proximal part of destructed wire-reinforced ETT may facilitate insertion of an inner tube. Second, except for the radius of the ETT and density of gas, the length of the ETT is another important contributing factor to airflow resistance.6 Therefore, shortening the length of the inner tube can significantly decrease ventilation resistance. Third, inflating the cuff of the inner tube can firmly secure stabilization of the two tubes together and avoid airway leakage without requiring any auxiliary maneuver or tool.

Finally, it must be emphasized that when ETT perforation or rupture accidentally occurs during surgery, the tube-in-tube technique can only be used as a temporary rescue airway measure, especially for the patients with a large body weight. If the tear in the ETT is small and it may be possible to approximate the damage site of the ETT, moreover, sealing the leak with gauze,7 nylon ties, ...
Ultrasound Guidance: Concerns and Safety Issues May Have Some Answers

To the Editor:

The letter by Cory brings to attention the importance of being aware of the bioeffects of ultrasound. It is a topic close to my heart and hence was exciting to read. Some of his queries may already have an answer. I would like to highlight some of the changes in the past few decades that he may have missed by oversight.

The safety concerns based on more than four decades of animal research prompted many organizations including American Institute of Ultrasound in Medicine and other international organizations to perform an in-depth analysis of this issue to arrive at conclusions and recommendations. These have been mostly comforting in that no human studies have yet identified a potential risk. But they all warn about the need for continued vigilance, especially with the use of currently available ultrasound machines with capabilities for higher outputs.

The other change that has happened is the display of indices for potential harm. The Food and Drug Administration mandated that machines with higher acoustic outputs display the thermal and mechanical indices to qualify for track 3, which shifted the responsibility of monitoring to the end user. These calculated indices based on the data derived from animal studies are worst-case scenario estimates for potential harm. Most modern machines are programmed to limit the indices by changing the pulse repetition frequency, the pulse duration, and so forth.

Various animal models of crush injury to nerves followed by insonation have shown faster recovery of function besides histologic signs of earlier myelination when compared with sham. Ultrasonic bioeffects on the nervous tissue seems to span from neurolysis with high-intensity focused ultrasound to changes in ion channels besides changes in amplitudes and latency with therapeutic ultrasound. All these changes were demonstrated at higher intensities or at least the upper limits of the diagnostic ultrasound intensities. Citing the capabilities of ultrasound to cause neurolysis may be an extreme as one should not be denied the use of the excellent image guidance that ultrasound provides.

Although animal studies have shown myriad effects with insonation, many well-conducted epidemiologic studies have failed to demonstrate causality. The claims about autism, dyslexia, and handedness with ultrasound exposure have been disproved by studies including a longitudinal follow-up of children whose mothers had more than one exposure to ultrasound during pregnancy.

Many animal studies have shown the potential for non-thermal effects with ultrasound including inertial and non-inertial cavitation especially in gas-containing bodies. Ultrasound has been shown to produce high temperatures and also generate free radicals during cavitation. But the threshold for both inertial and noninertial cavitation is lowered only with microbubble contrast agents and not with the larger bubbles as may be encountered during injections. Cavitation, a frequency-dependent phenomenon, may be unlikely with the bubbles that he refers to. It is further reduced as the radius of the bubble required for cavitation at the higher frequencies used in regional anesthesia and pain medicine becomes restricted to a very narrow range. A small study looking at lung hemorrhage during transechocardiography found no intraoperative evidence of lung hemorrhage as seen in animals. Human lung seems to be protected from nonthermal effects because of factors yet unknown.

As he mentions, the attenuation coefficient changes with fluid or injectate. Using the National Council for Radiation Protection deration may provide safety with low attenuation. But most importantly, keeping the indices and the duration of insonation within limits especially during use of power Doppler, a stationary mode, may be all that is necessary.

During the use of ultrasound guidance for regional anesthesia and pain medicine, mostly the B mode is used with constant movement of the transducer until the target is identified.

I do agree with him that the low-intensity values that ultrasound machines claim is derived and sometimes differ between machines, as all the manufactured machines do not