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On Reducing the Flammability of PVC

To the Editor:—Wolf and Simpson[1] have recently shown that PVC tracheal tubes have a higher O_2 index of flammability than either silicone (Si) or red rubber (RR) tracheal tubes, and recommend that "when an ignition source is in close proximity to the ETT (endotracheal tube), PVC tubes may be preferable to Si or RR tubes, provided a gas mixture is chosen that does not support combustion." We agree that PVC is a safe material for use during laser operations, provided it is used in the appropriate clinical setting, and would like to comment on two considerations that can increase its safety.

First, the PVC tracheal tubes that are in common clinical use do not consist only of PVC, but contain barium sulfate, a substance that lowers the temperature of the spontaneous ignition of plastic.[2] If one employs plain PVC, that is, tracheal tubes with no barium stripe and no markings whatsoever, the time to ignition upon exposure to laser energy is much longer and, thus, the procedure is safer than if one uses the more common tracheal tubes with markings.[2] Since they do not mention whether or not the tracheal tubes they tested had markings, we assume that Wolf and Simpson studied the common, marked PVC tracheal tubes that contain barium sulfate.

A second consideration is the diluent gas that Wolf and Simpson employed. We have established that, when helium/oxygen mixtures surround the PVC during laser exposure, thermal ignition is delayed longer than when nitrogen/oxygen mixtures are present;[2] however, Simpson and Wolf used nitrogen as their diluent rather than helium. Helium is effective in preventing PVC ignition up to an FI_{O_2} of 0.4, whereas nitrogen is only effective up to an FI_{O_2} of 0.25. Helium, therefore, not only provides a greater margin of safety during laser cases, it also allows the anesthesiologist to enrich the gas mixture with up to 40% oxygen when plain PVC tracheal tubes are in use.

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In Reply:—We welcome Drs. Pashayan and Gravenstein's constructive comments.

In reply to their first query, we tested a variety of polyvinylchloride (PVC) endotracheal tubes (ETTs), some with and some without the barium stripe. Our results for flammability for all PVC ETTs were similar.

In regard to diluent gas, it is well known that helium may diminish flammability, as was reported from our institution in 1956.[1] We are currently examining the effect of various diluents (including helium) on the Oxidant O_2 and Oxidant N_2O Indices of Flammability of PVC, red-rubber, and silicone ETTs. We plan to publish our results in the near future.

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