

N.A.V.E.L. May Not Be Right

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The endotracheal administration of diazepam has been widely taught in paramedic training programs as well as Advanced Cardiac Life Support (ACLS) classes. In fact the mnemonic N.A.V.E.L.⁶ (naloxone, atropine, Valium, epinephrine, lidocaine) was developed to help prehospital personnel recall the medications which can be administered endotracheally. However, there is very little evidence in medical literature supporting the use of endotracheal diazepam and it may be harmful to the pulmonary tissues.

One of the first researchers to investigate endotracheal administration of diazepam was Dr. William G. Barsan and colleagues at the University of Cincinnati.¹ In this study a 0.5 mg/kg solution of diazepam was diluted with enough 95 percent ethyl alcohol to obtain five milliliters of solution. The solution was administered to five mongrel dogs who were previously anesthetized. Blood levels of diazepam were periodically obtained and found to be comparable to those following intravenous administration of diazepam. Although there were no short term pulmonary complications, the long term effects of endotracheal diazepam were not studied as the dogs were sacrificed following the experiment.

In 1985 Drs. Pasternak and Heller at the Center for Emergency Medicine in Pittsburgh published the only report where endotracheal diazepam was administered to an adult.² The patient, a 76 year old female, was administered five milligrams of Valium endotracheally by paramedics which terminated her seizure activity. No pulmonary complications were reported.

In the only other published report a seven month old infant was administered one milligram of diazepam and no long term complications were reported.⁷ Many authors have subsequently written about endotracheal drug administration, but have primarily reviewed the literature and not described the actual use of endotracheal diazepam in humans.³⁻⁶

In another study Dr. Rusli and his colleagues studied the effects of endotracheal diazepam on 11 anesthetized cats.⁷ Six of the cats received endotracheal diazepam and five of the cats received endotracheal normal saline. At autopsy, there was a significant increase in pneumonia (an inflammation of the lung) in the cats who received diazepam compared to cats who received saline. Unlike Dr. Barsan's study, which used diazepam diluted with 95 percent ethyl alcohol, Rusli used commercial parenteral diazepam (Valium Hoffman-La Roche).

There are many problems with administering Valium endotracheally. The first is that commercial parenteral preparations of diazepam contain many ingredients other than diazepam. Each one milliliter of parenteral diazepam (Valium) contains 40 percent propylene glycol, 10 percent ethyl alcohol, five percent sodium benzoate and benzoic acid, and 1.5 percent benzyl alcohol.⁸

A second potential problem with the endotracheal administration of parenteral diazepam is the pH. The pH of the commercial diazepam (Valium) solution ranges from 6.2 to 6.9. This is more acidic than the normal pH of the pulmonary tissues (7.35-7.45). The short and long term effects of placing one to two milliliters of a relatively acidic solution into the lungs is not known but pulmonary inflammation, shunting, and infection are all possible complications.

The biggest problem related to the prehospital administration of diazepam is the fact that it must be diluted before administration. It has been established that at least five to 10 milliliters of drug solution are necessary for successful endotracheal drug administration for adult patients (one milliliter for infants).⁹ Diazepam is usually supplied in vials or pre-filled syringes which contain ten milligrams of the drug in two milliliters of solvent. In order to make a five or ten milliliter solution the drug must be di-

luted with a suitable solvent. Although highly soluble in alcohol, diazepam is virtually insoluble in water and most EMS units do not carry alcohol for diluting drugs thus making the endotracheal administration of diazepam impossible.

Perhaps additional research will be forthcoming which will establish the safety and effectiveness of endotracheal diazepam. Until then, EMS personnel should consider it the last alternative for treating status epilepticus in the prehospital setting. The intravenous or rectal routes are preferred.

References

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