Letters

Comparative propofol emulsion stabilities

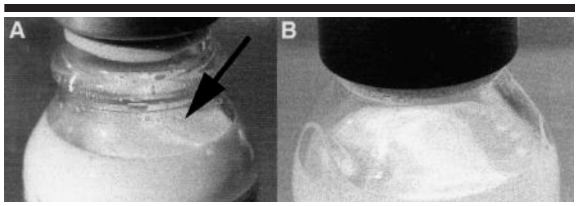
Letter to the Editor:

Propofol is supplied to the market in 2 formulations: an emulsion that contains disodium edetate (EDTA, 0.005%) as the antimicrobial agent (Diprivan) and an emulsion that contains sodium metabisulfite ($Na_2S_2O_5$, 0.025%) as the antimicrobial agent. There are significant differences in pH between the 2 formulations. The indicated pH range of Diprivan is 7.0 to 8.5, whereas the pH of the metabisulfite formulation is 4.5 to 6.4. A possible reason for the lower pH of the metabisulfite propofol is that the effectiveness of sulfite as an antimicrobial agent increases with decreases in pH. Whether initially in the sulfite (SO_3^{-2}), bisulfite (HSO_3^-), or metabisulfite ($S_2O_5^{-2}$) form, the antimicrobial effects of sulfite are largely due to sulfur dioxide (SO_2), the release of which from sulfite is greater with increasing hydrogen ion concentrations.[1]

Both of these propofol formulations are oil-in-water emulsions that consist of very small emulsified soybean oil droplets (0.2-0.25 μm in diameter) suspended in an aqueous phase.[2] The oil droplets containing the propofol are inhibited from coalescing with each other in part by a negative surface charge, resulting from adsorbed phospholipids, which causes a small repulsive force between droplets. Lowering of the pH is known to decrease the stability of such oil-in-water emulsions because the negative charge is neutralized by hydrogen ions.[3] Support of this effect in the commerical propofol preparations was made by agitating vials of Diprivan and the metabisulfite formulation. Fifty milliliter vials of metabisulfite propofol emulsion (lot 99C301, exp. 03/01) and Diprivan (lot 4787Y, exp. 11/99) were bound together and mechanically shaken horizontally for 6 hours (248 cycles/min, 1 ¾-inch travel) at room temperature.

After standing overnight, numerous clear oil globules could be seen adhered to the glass of the metabisulfite formulation (see arrow in Figure). Free oil, the formation of which is called cracking, is also present on the emulsion surface as shown by irregularities of the surface-glass interface. The EDTA formulation did not show any visible oil. Multiple repetitions of this procedure yielded similar results.

Figure. **Vials of propofol emulsions containing metabisulfite (A) or disodium edetate (B) following mechanical shaking**



This comparison supports the predicted differences in stability between the formulations. Because the original particle sizes are very small, initial stages of droplet enlargement are not visible. In addition to the administration of larger oil droplets to the patient, sufficient droplet coalescence can result in creaming, ie, rising of the larger oil droplets in the liquid medium, which can potentially alter localized propofol concentrations in the vial.

It has yet to be reported if there are clinical consequences due to differences between the 2 emulsions (yellowing upon air exposure is a different process than emulsion breakdown); however, the metabisulfite propofol emulsion will likely exhibit less stability than the EDTA formulation under conditions that stress emulsions. These conditions include, for example, high temperature, freeze-thawing, agitation, or a combination of these conditions.[3]

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(3) Davis SS, Hadgraft J. Palin K. In: Becher P. Medical and pharmaceutical applications of emulsions. *Encyclopedia of Emulsion Technology*. New York, NY, and Basel, Switzerland: Marcel Dekker; 1983;2:159-238.

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Dental guards: Helpful or hazards?

Letter to the Editor:

I would like to augment the information concerning patient's dental prostheses presented in the April 2000 *AANA Joumal* article titled "Dental guards: Helpful or hazards? — A case report (2000;68:127-130), authored by Linda R. McFadden, CRNA, MSN; John M. O'Donnell, CRNA, MSN; and Carol E. Rose, MD. The article states that "dental appliances (crowns and bridges) are often made from porcelain and acrylic and tend to be brittle. These appliances fracture under pressure during instrumentation of the airway."

Tooth-colored crowns placed on the anterior teeth are usually of two varieties: porcelain fused to metal or an all-ceramic crown. Rarely is acrylic used for anterior crowns, except as temporary crowns. Acrylic is too soft, is a harbor for bacteria, and is not resilient to the hostile environment of the mouth. Porcelain is a very brittle glass substance that is applied to a custom made metal shell for each tooth and then baked in a porcelain-firing oven, where the porcelain glass mechanically fuses to the rough surface of the metal shell.

Each of the metals used for the shell is specifically designed to be used with a special porcelain. Herein lies the problem for the CRNA. Any force placed on the porcelain, other than as a chewing pressure, will fracture the porcelain or fracture the porcelain bond to the metal shell. An all-ceramic crown is more resilient to the accidental force from a laryngoscope blade, because it is homogenous in consistency: it is all ceramic, there is no metal shell, but it too can shatter from the force of a laryngoscope blade.

A tooth properly shaped with a dental drill for a crown or bridge tapers at a slight angle from the vertical, tapering from the gum line of the tooth to the tip of the tooth. A good crown will stay on the tooth with friction. Cement is used to enhance the retention of the crown to the tooth and seal the edges of the crown.

Biting forces are immense. The masticatory muscles can generate more than a ton of pressure in certain areas of the mouth. Think of the force your front teeth generate to cleanly bite off a fresh apple or corn on the cob. Unless a crowned tooth is carious (has a cavity) or has periodontal disease, it is very resilient to biting forces but may not be resilient to the nonchewing force vectors of a misused laryngoscope blade.

A dentist can take an impression of the teeth and fabricate a quick and inexpensive vacuum-formed custom-fitted dental guard for the maxillary or the mandibular arch of teeth. Some dentists have to use a dental laboratory to construct the guard, so planning ahead is necessary. The cost of the guard is a fraction of the cost for a new crown or bridge. The old adage "an ounce of prevention is worth a pound of cure" is applicable, especially when injuring a patient's dentition and potential malpractice claims are involved.

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