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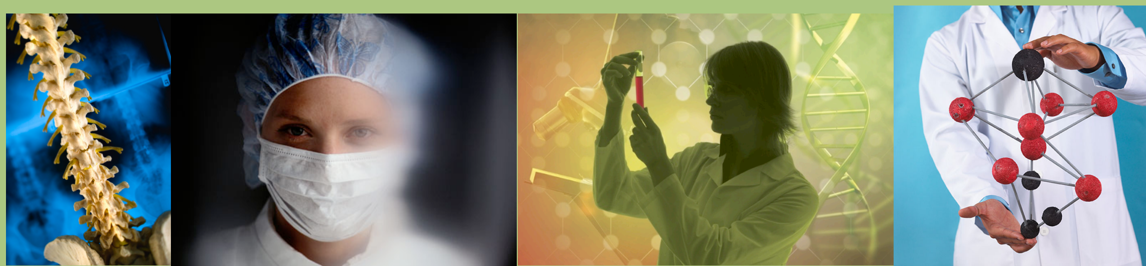

News You Can Use

April 18, 2007

Altering Bupivacaine

True or false. Adding sodium bicarbonate to bupivacaine does not shorten its onset of action. If you answered false, you would be wrong...at least from a theoretical stand point. Before I explain my self, let me go on record to say that it doesn't make much sense from an economic point of view to alter the species of bupivacaine if you only do it once in a while. Where I work, sodium bicarbonate (the 8.4% variety) comes packaged in 50 ml bottles. Commercially prepared 0.5% bupivacaine usually has a pH of 5.33 and to raise its pH (that is lower the concentration of its hydrogen ions)from 5.33 to 6.96, only 0.1ml (that's one tenth of a milliliter) of sodium bicarbonate is needed for each 10 ml of bupivaicaine. Any attempt to raise the pH of the solution further really doesn't change the species of the drug to any great extent (see below) but more importantly you run the risk of causing the local anesthetic to precipitate out of solution (which of course makes it ineffective). Oh yes, now that you've opened that bottle of sodium bicarbonate and drawn off your 0.1 ml of solution what do you do with the remainder of the stuff? You can't save it for another day. It doesn't contain a preservative and the maufacturer's label indicates its for single use only. Anyway, you get my drift. Okay, now on to the issue at hand. When you alter the pH of bupiaicaine from 5.33 to 6.96, you make a substantial change in the hydrogen ion concentration. The hydrogen ion concentration falls by 97% and by extension the nonionized species (that's the fraction of the drug that actually enters the nerve fiber) increases from 0.19% to 7.52% (see:Covino BG, Vassallo HG. Local Anesthetics: Mechanisms of Action and Clinical Use. New York, NY: Grune & Stratton; 1976:7,pp.17-18, 106-113). By the way, that's also a change of 97%. And how do I know this, you may ask? Well consider that a solution with with a pH of 5.33 has 47 $x10^{-7}$ hydrogen ions and a solution with a pH of 6.96 has 1.1 x 10^{-7} hydrogen ions. And if you do the math (see my footnote) , you can see that there is a 97% change in the hydrogen ion concentration. I know, your next question would probably be, "How do I know how many hydrogen ions there are in a solution?" To figure that out, one needs to remember that pH means the negative logarithm (log) of the hydrogen ion concentration and the negative log of 5.33 is the same thing as saying: .67 - 6 or .67 $x10^{-6}$ and the antilog of.67 is 4.7. (Trust me on this. I have an old chemistry book that includes a logarithmic table). Hence a solution with a pH of 5.33 contains 4.7 x 10^{-6}(or 47 x 10^{-7}, if you move the decimal point one space to the right) hydrogen ions. Likewise a pH of 6.96 means the same as .04 - 7 or .04 x 10^{-7} and the antilog of .04 is 1.1. Consequently a pH of 6.96 contains 1.1 x 10-7 hydrogen ions. I hope this answers your question.

(Footnote: (47 $x10^{-7}$)- (1.1 x 10^{-7})divided by (47 x 10^{-7}) 97% change)