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*In reply:*—We thank Drs. Chen *et al.* for their interpretation of our results and accept the fact that their explanation is perhaps more explicit than ours. However, we are not sure that it is a complete explanation. If one chooses to explain the differences between Bicitra® and sodium citrate on the basis that Bicitra® is a “buffering” agent, then one also has to consider how sodium citrate reacts. To do so one must invoke the Henderson-Hasselbalch equation:

$$pH = P_k + \log \frac{A^-}{HA}$$

For Bicitra®, the A<sup>-</sup> would be contributed by sodium citrate and the HA would be citric acid. As Bicitra® mixes with hydrochloric acid, a strong acid and therefore highly dissociated, the citrate combines with free hydrogen ions, resulting in the formation of citric acid. Because citric acid is a weak acid, and therefore mostly undissociated, there are fewer free hydrogen ions available to influence pH. In the case of sodium citrate, exactly the same thing happens when it is added to hydrochloric acid. That is, the citrate combines with hydrochloric acid to form citric acid, resulting in a

higher pH. In this instance, however, there is less citric acid present because there was none to begin with—as there was with Bicitra®. Although citric acid is a weak acid and exists in a relatively undissociated state, it does contribute a small number of free hydrogen ions to the solution. Therefore, the more citric acid, the lower the pH, thus accounting for the less efficient action of the Bicitra® solution.

We hope the above explanation clarifies our thoughts on the matter, and we thank Dr. Chen and colleagues again for bringing up the matter for discussion.

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## An Apparent Seizure Following Inadvertent Intrathecal Morphine

*To the Editor:*—Convulsions are said to be a theoretic complication of intraspinal narcotics,<sup>1</sup> though a search of the literature failed to reveal any such communications. I wish to report what, based on clinical observation, seems to be such a case report.

A 53-year-old, previously healthy woman with primary breast cancer and metastases to the spine was seen in consultation for pain relief. Her only medication at this time was morphine elixir, which was producing excessive sedation. An epidural catheter and epidural narcotics were suggested and agreed upon by patient and oncologist. The catheter insertion was relatively straightforward, and a test dose of 40 mg lidocaine was administered with little resistance to injection. About 10 min later, the patient exhibited signs of mild sensory and motor block and by another hour was able to move her legs only with great difficulty. Later that afternoon, 15 mg of preservative-free morphine was injected into the catheter with fair relief of pain. Twelve hours later, the resident came to administer a second dose of morphine. He found it very difficult to inject the fluid but managed to do so over a 4-min period. At the end of the treatment, the patient suddenly began to hyperventilate and exhibit tonic

posturing of the upper extremities with deviation of the head and eyes to the left side. She was totally unresponsive to verbal commands, and an arrest was called. One minute later the patient just as quickly became fully conscious but complained of nausea, and she vomited a few minutes later. Vital signs at this time were normal and the patient had total amnesia for the event. Examination of the fluid coming out of the catheter showed it to be glucose positive, and the catheter was removed. Throughout this time there was no incontinence, tongue biting, or postconfusional state.

A neurologic consultation was requested. This patient had no history of seizures; her CT scan after the event showed a tiny dense focus in the right frontal area, unchanged since February 1984, with no metastases evident; and her EEG showed a mild-moderate slight paroxysmal abnormality in the left temporal region, with spread to the sylvian fissure. The neurologist concluded from this that the patient most likely did have a seizure and speculated this could have been a result of the intraspinal narcotic administration.

In conclusion, this case illustrates two possible hazards to be aware of during epidural analgesia: catheter migration and convulsions from high-pressure injection of intrathecal narcotics.