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Regional Anesthesia: Vintage Bordeaux (and Napa Valley)

"Because it is rare for serious cardiac and neurological complications to occur in association with regional anesthesia, published information regarding critical serious events are found primarily as retrospective studies or individual case reports."[1] Thus begins the report of a remarkable prospective collection of more than 100,000 consecutive cases of regional anesthesia in France in 1994. The study of rare events is never easy or complete, but is an essential element of rational progress in medicine. This French study, although not perfect, is a significant step forward in our study of rare, catastrophic events that occur during regional anesthesia and surgery, and it corroborates long-held precepts, and at the same time provides surprising and important new observations. The following are some previous observations that are confirmed in the current study.

1. **Regional anesthesia is safe.** In more than 40,000 epidural, more than 30,000 spinal, more than 20,000 peripheral nerve block, and more than 10,000 intravenous regional anesthetics performed by or under the supervision of 736 French anesthesiologists, the risk of neurologic injury lasting more than 3 months was 0.5/10,000 (95% confidence intervals [CI] 0.2–1.1/10,000), and the risk of death was 0.7/10,000 (95% CI 0.2–1.2/10,000). This is a remarkable safety record. One could argue that sampling bias and lack of extensive auditing of the case population limit severely the certainty of these estimates. I would agree with the authors' assertion that serious adverse events were unlikely to have been missed and that the prospective and short-term nature of the study give it significant advantages over previous retrospective reports regarding accuracy.
2. **Complications may occur even in the hands of experienced anesthesiologists.** The average length of experience in performing regional anesthetics among anesthesiologists who reported complications in the current study was 12 yr. Some of these anesthesiologists were in academic institutions and may have been supervising less experienced individuals. Nearly half of these were in private practice and, based on my not-so-random sampling of French anesthesiology practices during my sabbatical there in 1995, were personally performing their own regional anesthetics. Not only were these experienced anesthesiologists, but they were avid practitioners of regional anesthesia; they averaged more than 30 cases of regional anesthesia per month during the period of data collection. They performed 67% more regional anesthetics than their colleagues who did not report complications during the same time.

I believe these observations provide two important hints to etiology and prevention of complications from regional anesthesia. First, experience leads to improved success rate, but rare complications may nonetheless occur. Second, cardiac arrest during regional anesthesia occurs rarely, but it is the cause of the majority of fatalities. The experience in the current study mirrors the American experience[2] of bradycardia heralding cardiac arrest, just as increased end-tidal CO_2 may herald malignant hyperthermia. How to teach and reinforce vigilance for these sentinel events remains a conundrum in the continuing education of anesthesiologists.

◆ These Editorial Views and Highlights accompany the following original articles: Auroy E, Narichi P, Messiah A, Litt L, Rouvier B, Samii K: Serious complications related to regional anesthesia: Results of a prospective survey in France. ANESTHESIOLOGY 1997; 87:479–86; Sharma SK, Sidawi JE, Ramin SM, Lucas MJ, Leveno KJ, Cunningham FG: Cesarean delivery: A randomized trial of epidural *versus* patient-controlled meperidine analgesia during labor. ANESTHESIOLOGY 1997; 87:487–94; Reasoner DK, Hindman BJ, Dexter F, Subieta A, Cutkomp J, Smith T: Doxycycline reduces early neurological impairment after cerebral arterial air embolism in the rabbit. ANESTHESIOLOGY 1997; 87:569–76; Gerancher JC: Cauda equina syndrome following a single spinal administration of 5% hyperbaric lidocaine through a 25-gauge Whitacre needle. ANESTHESIOLOGY 1997; 87:687–9.

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3. **Local anesthetics may produce seizures.** The rate of seizures after injection of local anesthetics (2.2/10,000) was considerably greater than those for permanent neurologic injury or death in the current study. More drug is injected for peripheral nerve block than for epidural anesthesia, and it is not surprising that the incidence of seizures was higher (7.5/10,000) with peripheral nerve block than with epidural anesthesia (1.2/10,000). My non-random sampling of French anesthesia practice suggests that peripheral nerve block is more commonly used in that country than in the United States and that the French are cognizant of the dangers of intravascular injection or rapid absorption of local anesthetics. I emphasize heavily the need to test epidural catheters and to inject the total dose in several small increments to avoid systemic toxicity from accidental intravascular injection. Even greater emphasis should be placed on careful technique and the risk of systemic toxicity from local anesthetic injection during peripheral nerve block.
4. **Inserting a needle into a nerve may cause injury.** In more than 60% of the cases of postoperative radiculopathy, a paresthesia was perceived with needle insertion for spinal or epidural anesthesia or peripheral nerve block. In all patients, the radiculopathy was in the same distribution as the paresthesia, and in all but one patient, the radiculopathy was temporary. Only two of these cases involved peripheral nerve block; the remainder probably represented needle trauma to nerve routes in the intrathecal or epidural spaces. It is possible that these could have been avoided with slower needle advancement, although it is unclear whether these temporary injuries are a result of faulty technique, and the admonition that, "Direct needle trauma and intraneuronal injection of local anesthetic are avoidable causes of nerve injury"[3] does not seem clearly justified. In only two cases in the current study, representing $< 10\%$ of cases of radiculopathy, was paresthesia perceived on injection of local anesthetic.
5. **Regional blocks sometime fail.** We have all been warned not to follow the slippery slope of sticking with a therapy that is failing. The wisdom of this warning in underscored by the three cardiac arrests in patients with peripheral nerve blocks, all occurring in the setting of inadequate anesthesia. Although details are not provided, it is not hard to imagine the events leading to these two vasovagal arrests and one fatal myocardial infarction. Inadequate anesthesia is just that and leads to patient morbidity.

There also are a few surprises in this study that have lessons to teach. First, bupivacaine is considered, and rightly so, to be highly cardiotoxic. Yet there were 14 seizures after bupivacaine injection in this study with no obvious cardiotoxicity. Perhaps this is because these were not obstetric patients, and intense education and awareness of bupivacaine-induced cardiotoxicity led to rapid response and resuscitation in these patients. One could look on this as a victory for continuing medical education. Alternatively, it is clear that bupivacaine and ropivacaine are more cardiotoxic than other local anesthetics in clinical practice, and reports of seizures without cardiac arrest with either agent should not lull us into a false sense of security. Second, spinal anesthesia appears in this study to be more dangerous than other regional anesthesia techniques at first glance because the risk of cardiac arrest is five- to sixfold greater and of neurologic injury is two- to threefold greater with spinal than with other regional anesthetic techniques.

Is spinal anesthesia dangerous? I would say. "No and yes" and will build my case on the 1953 edition of Pitkin's *Conduction Anesthesia*,[4] which my father used in family practice and later in anesthesia before passing it on to me. The current, 1994 study reveals a death rate of 1.5/10,000 spinal anesthetics, not significantly different from that reported in Pitkin's text from a study of 300,000 spinal anesthetics 65 yr earlier (1929). Given that the patients today are more likely sicker and the surgeries more invasive and complex than 65 yr ago, I find this a remarkable statistic. As the authors of the current study themselves assert, the apparently increased danger of spinal anesthesia may relate more to the surgery (*e.g.*, cardiac arrests during cementing of hip prosthesis) and to the patients (mean age 82 yr in those not surviving the cardiac arrest) than to the spinal anesthetic itself. Or, as quoted in Pitkin, "In reviewing these deaths, the greatest number were patients whose approaching death was plainly evident and death would have been inevitable no matter what anesthesia had been involved."

In summary, this large, prospective study from France confirms the safety of regional anesthesia but also confirms that, even in experienced hands, cata-

strophic complications may occur. This represents a challenge to methods and content of training and continuing education. Spinal anesthesia has a remarkable safety record in high-risk surgical populations, but the concern over the continued use of 5% lidocaine for spinal anesthesia deepens. Those of us on this side of the Atlantic thank the French for this contribution and join them in their conclusion, "Vive l'anesthesie locoregionale!"

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Lidocaine Spinal Anesthesia

A Vanishing Therapeutic Index?

In 1991, reports of cauda equina syndrome after continuous spinal anesthesia generated concern about the potential neurotoxicity of anesthetics currently used for spinal anesthesia.[1] Almost all of these cases occurred with use of 5% lidocaine, an anesthetic considered by many to be the gold standard for safety. That neurotoxic damage could occur with clinically relevant concentrations was reinforced by reports of deficits with repeat injection after a failed spinal block[2] and with inadvertent intrathecal injection of an intended epidural dose of 2% lidocaine.[3] Subsequent reports demonstrated that, in addition to permanent deficits associated with high doses, transient neurologic symptoms, *i.e.*, pain/dysesthesia in the buttocks or lower extremity, frequently follow standard intrathecal doses of lidocaine.[4,5]

In this issue of ANESTHESIOLOGY, two manuscripts now present cases in which neurologic deficits were associated with administration of local anesthetic at a dose recommended for single injection spinal anesthesia.[6,7] Gerancher details a single case of cauda equina syndrome after uncomplicated spinal anesthesia with 100 mg of lidocaine with epinephrine.[6] Auroy *et al.*, the subject of a separate editorial, found 24 neurologic deficits among approximately 40,000 spinal anesthetics,[7] 12 of which were associated with trauma evidenced by either paresthesia or pain with injection. Of the remaining 12, 9 occurred with lidocaine (including all three that were permanent). For these nontraumatic deficits, the authors failed to identify an etiology of injury, leaving the anesthetic as a potential cause. But what evidence is there that injuries resulted from the anesthetic? Certainly, lack of an alternative etiology, *per se,* is a weak argument for toxicity.

First injury as a result of the toxicity of an anesthetic should be dose-dependent. That is, injuries should cluster at the high end of the clinical dose range, with the most severe at the highest doses. One of the permanent deficits described by Auroy *et al.* occurred with 350 mg of lidocaine administered through a continuous spinal catheter. Although the manuscript reports only a range (75-100 mg) for injury with single injections of lidocaine, a query to the authors elicited data supporting dose-dependence - seven of the eight deficits followed injections of 100 mg; two deficits were permanent, and five lasted from 2 days to 16 weeks. Only one patient received a lower dose (75 mg) and symptoms lasted only 3 days.

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