humans (Shafer and Eisenach, unpublished data, October 1999) that demonstrate little difference in dermato-
mal spread in CSF of fentanyl compared with morphine
after intrathecal injection. Thus, the extrapolation from
pigs to humans and from models of CSF and tissue
kinetics to clinical effects is far from certain.

In summary, the article by Ummenhofer et al. is a
seminal work in intrathecal pharmacokinetics. It directly
incorporates location into the pharmacokinetic model,
based on observations taken at multiple points in the
intrathecal space. Based on their results, we can no
longer ignore the relationship between sampling site and
the site of the target tissue when characterizing spinal
pharmacokinetics. We also need to rethink spinal drug
administration to localize drug delivery to the spinal
target. The future of intrathecal pharmacokinetics is
now location, location, location.

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How Do We Measure (the Cost of) Pain Relief?

HOW do we measure the cost of pain relief? In this
issue of Anesthesiology, Macario et al. estimate that
the expected cost to society of epidural analgesia for
pain relief during labor ranges from $259 to $338
greater than the expected cost of intravenous analge-
sia. The manuscript is instructive, and my initial reac-
tion is that epidural analgesia is a bargain! However, it
seems appropriate to ask two questions: (1) Is the
authors’ question a valid one? and (2) Is the analysis
valid?

The Question

Most studies of healthcare cost include an analysis of
the benefit of the intervention. For example, many stud-
ies report quality-adjusted life years as an outcome mea-
sure. Macario et al. chose not to do a cost-effectiveness
analysis, suggesting that this approach may not apply to
the management of labor pain. The authors state that
"valid techniques to value quality of life from better
analgesia do not exist." (Indeed, how does one assign a
dollar value to the provision of a service that is deemed
essential during performance of surgery?) Thus, Macario
et al. did not ascribe a monetary value to the benefit of
pain relief obtained from epidural analgesia. Rather, the
authors cited a meta-analysis that quantified and summa-

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thesia; productivity; workload.

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rized the better pain relief and enhanced patient satisfaction provided by epidural analgesia when compared with intravenous opioid analgesia in laboring women.\textsuperscript{2}

Readers may conclude that these investigators have demonstrated the obvious. In other words, it seems intuitive that if a second physician (\textit{i.e.}, an anesthesiologist) is involved in a patient’s care and that physician performs a procedure, it will result in increased cost. Curiously, few would compare the cost of anesthesia \textit{versus} no anesthesia for surgery. This would have been unthinkable a few years ago, but carrier medical directors for the Health Care Financing Administration have provided an unwelcome approach with their column A/column B lists for monitored anesthesia care. Nonetheless, the question posed by Macario \textit{et al}.\textsuperscript{3} reflects, in part, the ambiguity—yes, even the double standard—that continues to exist in modern health care. Some healthcare payers and providers (even some members of our specialty) still consider effective intrapartum analgesia to be elective. I acknowledge that some parturients choose not to receive analgesia during labor. But most women experience severe pain during labor, and a majority of parturients now choose to receive a regional anesthetic technique for relief of pain during labor and delivery.\textsuperscript{5}

The Analysis

Macario \textit{et al}.\textsuperscript{1} have assumed that administration of epidural analgesia to a laboring woman decreases the availability of an anesthesiologist to provide care elsewhere (\textit{e.g.}, in the operating room). However, I do not agree with the assumption that dollars spent to administer epidural analgesia represent someone or something being unavailable for someone else. In fact, the opposite scenario is more likely to occur. Consider a small hospital with only one anesthesiologist available at midnight, when one patient requires an exploratory laparotomy for an acute abdomen and a second patient requests epidural analgesia for labor. In this circumstance, it is most likely that the first patient will receive anesthesia for the laparotomy, but the second patient will not receive epidural analgesia. (Or at best, epidural analgesia will be delayed until completion of the laparotomy.)

Under more ideal circumstances, an anesthesiologist is assigned on a full-time basis to the obstetric service. Thus, his/her costs are fixed, and administration of fewer epidural procedures will not result in increased availability of anesthesia services for other patients. Rather, under these circumstances, administration of fewer epidural procedures will result in an increased per-procedure cost, and in reality, this makes it more difficult for the anesthesiologist to ‘‘break even’’ while providing obstetric anesthesia services. Given the episodic nature of even a busy obstetric practice (unlike scheduled surgery in the operating room), a full-time obstetric anesthesiologist will experience unavoidable periods when he/she is not engaged in revenue-producing activity. Anesthesiologist assigned to the obstetric service on a full-time basis is rarely able to supplement his/her income by providing nonobstetric anesthesia services. Thus, Macario \textit{et al}.\textsuperscript{1} likely underestimated the personnel costs by not assigning a dollar value to nonproductive ‘‘down’’ time, a factor that must be considered for hospitals with a full-time obstetric anesthesiologist.

This study has two other limitations. First, one study has suggested that epidural analgesia may indirectly result in an increased incidence of neonatal sepsis evaluations as a result of an association between epidural analgesia and maternal fever during labor.\textsuperscript{4} No study has demonstrated that epidural analgesia increases the incidence of neonatal sepsis, but if epidural analgesia predisposes to maternal fever—and thus increases the likelihood of a neonatal sepsis evaluation—this would increase the total cost to society of epidural analgesia. (One newspaper discussed this study in an article entitled, ‘‘Study associates fever and epidurals.’’\textsuperscript{5} Cohen [personal communication] suggested that a more appropriate title would have been, ‘‘Study finds problems identifying infected babies.’’) The relationship between epidural analgesia and maternal fever remains controversial and deserves further study.\textsuperscript{6,7}

Second, the investigators did not measure the possible reduction in maternal morbidity and/or mortality that may result from administration of epidural analgesia during labor, especially in patients at high risk for complications of emergency administration of general anesthesia. Hawkins \textit{et al}.\textsuperscript{8} observed that the maternal case fatality rate for general anesthesia was 16.7 times that for regional anesthesia among obstetric patients in the United States for the years 1985–1990. Thus, the present study may have underestimated the benefits of epidural analgesia.

Also in this issue of \textit{Anesthesiology}, Bell \textit{et al}.\textsuperscript{9} report their analysis of the revenue \textit{versus} cost for assigning faculty anesthesiologists to provide obstetric anesthesia services in a university hospital. In this study, the anesthesiologist’s labor cost per patient receiving epidural...
analgesia during the study period was $325 with intermittent staffing and $728 with dedicated faculty staffing 24 h/day. The investigators likely underestimated their personnel costs, given that they did not include the costs for other members of the anesthesia care team (i.e., residents, certified registered nurse anesthetists). Undoubtedly these other providers improved the productivity of the faculty anesthesiologist, especially during periods of peak demand.

Most troubling was the authors' comparison of revenue versus costs. Specifically, they determined that Medicaid reimbursement for epidural analgesia was not sufficient to cover their costs. Even with a productivity level of 70%—a rate considered optimal for emergency service areas—Medicaid reimbursement would not cover their faculty anesthesiologists’ salary costs. Thus, Bell et al. successfully refuted the argument that anesthesiologists can “break even” by performing more obstetric anesthesia procedures for Medicaid patients. More troubling is the fact that North Carolina Medicaid reimbursement for epidural analgesia is among the highest among the states for which data are available. Thus, the revenue-versus-cost analysis at the authors’ hospital is likely better than at many institutions in other states with a large Medicaid obstetric population.

Our obstetric colleagues have successfully lobbied their state governments for equitable reimbursement for their services. Unfortunately, Medicaid reimbursement for obstetric anesthesia services continues to lag in many states. Bell et al. acknowledged that Medicaid is not the only payer for obstetric anesthesia services in their hospital. However, as other payers decrease their reimbursement, cost shifting becomes increasingly difficult.

Together, these two studies provide further evidence that it is not enough to be a good doctor in contemporary anesthesia practice. Rather, we must understand economics and business, and we must participate in the political process. We must remind—even persuade—policymakers and payers that intrapartum epidural analgesia adds real value (perhaps immeasurable) to obstetric care, and our services have real—although not unreasonable—costs.

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