

◆ EDITORIAL VIEWS

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Obstetric Anesthesia

What Have You Done for Us Lately?

AN article in this issue reports that cervical dilation is more rapid in women receiving combined spinal-epidural analgesia (CSE) compared with epidural analgesia for the treatment of labor pain.¹ A similar observation was reported recently in another article in ANESTHESIOLOGY that found more rapid cervical dilation with lumbar sympathetic block than with epidural analgesia.² Neither study revealed a difference in the mode of delivery or obstetric outcome for the techniques studied, which could lead to the logical question, So what? I would like to address this question generally with a quick review of the history of obstetric anesthesiology research and more specifically regarding the progress of labor.

Obstetric anesthesiology research appeared as a real endeavor more than 30 yr ago, at a time when the pain of labor was largely ignored or treated with methods that were ineffective (small systemic doses of opioids) or entailed significant side effects to the mother (twilight sleep) or the fetus (paracervical block). Research in this area led rapidly to the provision of safe and effective analgesia in laboring women, with continuous epidural analgesia supplemented, more recently, by spinal injections. As with much of clinical medicine, a large area of research in obstetric anesthesiology focuses on the details of therapy (*e.g.*, the method of drug delivery, concentrations of local anesthetics, the use of adjuvants, and the prevention or treatment of side effects). These studies have clearly improved safety (by providing ways to avoid the catastrophic consequences of accidental intravenous and intrathecal injections of large doses of local anesthetics, and by helping us to understand the importance of patient positioning in maintaining uteroplacental perfusion) and patient comfort (by reducing dense motor block and even allowing ambulation).

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No doubt that these studies have been useful in guiding therapy, but they clearly do not address fundamental questions of general importance and interest in perinatal medicine and anesthesiology. Indeed, we could argue that there has been a progressive decline in the quality of questions addressed by obstetric anesthesiologists in the past 30 yr, from a fundamental understanding of the regulation of uteroplacental perfusion and its alterations by regional anesthesia in the 1970s to the very narrow question of whether epidural analgesia causes cesarean sections or maternal fever in the 1990s (fig. 1). We most certainly need both types of research: the *what* and the *why*. Unfortunately, the latter has, with the exception of efforts by a few persons, been rapidly dwindling.

To return to the current question, these studies suggest that, among nulliparous women who request more than systemic opioids for labor analgesia, cervical dilation occurs more rapidly with CSE (local anesthetic plus opioid) or lumbar sympathetic block (local anesthetic) than with epidural analgesia (local anesthetic plus opioid). Does this mean that CSE and lumbar sympathetic block speed labor, or that epidural slows it? Why? We can address this issue at a gross level (*e.g.*, the difference in motor block, sympathetic efferent block, and circulating drug concentrations) and, simultaneously, at a somewhat finer level (*e.g.*, on an endocrine, paracrine, or neural basis).

Asking why may lead to a better understanding of the regulation of the labor process, with important implications for major public health issues, such as the cause, prevention, and treatment of premature labor. Asking why may also change our role from that of primarily an important assistant ("merely" providing analgesia for labor) to that of a true consultant (diagnosing dysfunctional labor—whether too fast or too slow—and prescribing appropriate therapy). The clear relation between pain and obstetric outcome³ and the findings of the current study¹ and that with lumbar sympathetic block² suggest that pain and its treatment are central to obstetric management, and that this consulting role in labor management is not improbable. But *why* must be answered before *how* can be asked.

Anesthesiology is the practice of medicine. It involves diagnosis, prescription, and assessment, with research directed toward each of these activities. We need to

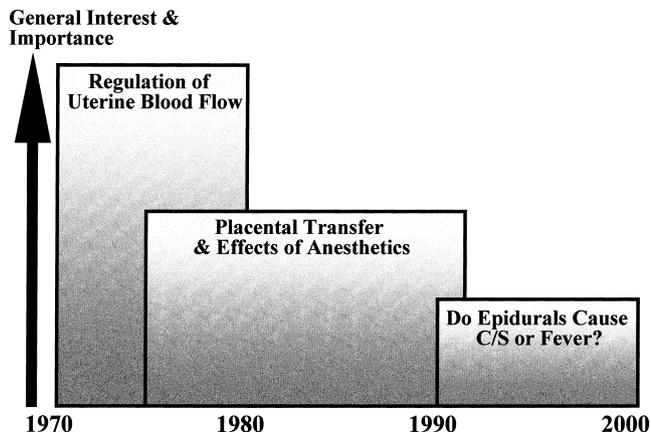


Fig. 1. The general importance and interest of some major questions posed in obstetric anesthesiology during the last 30 yr.

know whether epidurals lead to cesarean section deliveries or neonatal sepsis workups, and whether it is better to use more opioid and less local anesthetic for epidural analgesia during labor. As physicians, however, we must also address the basic neurobiologic and perinatal issues that are at the center of our practice.

Neurophysiologic Basis of Labor Pain

What is the neuroanatomy of uterocervical nociception in labor, and why is the pain of labor so variable among women, when these same women differ little in response to experimental pain stimuli? What is the role of vagal afferents in labor pain? Is local inflammation important in uterocervical nociception of labor pain, and does clinical application of prostaglandins to ripen the cervix sensitize these afferents and increase pain?

Neuropharmacology of Visceral Afferents

What inhibitory receptors are expressed at the peripheral and central terminals of uterocervical afferents? Why is spinal morphine potency reduced so much for labor pain compared with postoperative pain? Can peripheral inhibitory mechanisms be harnessed to provide labor analgesia without spinal or epidural injections? What plastic changes occur in signaling or inhibitory mecha-

nisms in uterocervical afferents during prolonged stimulation during labor?

Regulation of Labor

What is the role of neural influences on the regulation of labor, and what neuroanatomy does this reflect? What neuropeptides are present in peripheral afferent terminals, are they released during nociceptive stimulation, and do they regulate cervical remodeling? What is the role of uterine vagal afferents in the endocrine regulation of labor? How are these processes altered by our analgesic interventions?

Fetal Response to Asphyxia

Why does the fetal hormonal response to asphyxia differ so much from the adult? Are the stimuli for ischemic or programmed cell death identical in the fetus and the adult? How do mechanisms for redistribution of cardiac output during asphyxia differ between the fetus and the adult?

These are but a few questions. They may not be the best ones to ask. We could probably think of others. The point is that, in addition to knowing how to do things and what these interventions do to physiology (such as the progress of labor^{1,2}), we need to remember to ask *why*, or we stifle ourselves and reduce our field to a technical exercise.

James C. Eisenach, M.D.

F. M. James, III Professor of Anesthesiology
Department of Anesthesiology
Wake Forest University School of Medicine
Winston-Salem, North Carolina
eisenach@wfubmc.edu

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Anesthetic Management of the Elderly

Measuring Function beyond the Immediate Perioperative Horizon

For the ignorant, old age is winter; for the learned, it is the harvest.

—Hasidic Saying

THE elderly population is steadily increasing in both absolute and relative terms as a result of the aging of the baby boomers, healthier lifestyles, and advances in health care. It is estimated that approximately 15% of the U.S. population is older than 64 yr of age, and in the yr 2020, this proportion is likely to be approximately one fifth of the population. Physical function and cognitive dysfunction are reported to predict 5-yr mortality in this population.¹ In an attempt to improve function, enhance independence, and increase longevity in the elderly, surgical interventions such as total hip and knee replacements are likely to be performed more frequently in the future. Cognitive declines that may result from surgery and anesthesia are of particular concern in older adults. Therefore, controlled clinical trials that carefully evaluate the long-term outcomes of anesthetic techniques in older adults are of considerable clinical significance. In this issue of *ANESTHESIOLOGY*, Williams-Russo *et al.*² report that elderly patients can safely undergo total hip replacements using a controlled hypotensive epidural anesthetic technique with few cognitive, cardiac, or renal complications.

The hospital admission rate of the elderly, particularly octogenarians, has been increasing dramatically over the last decade. In particular, emergency admissions are more frequent in this age group. Compared with the younger population, postoperative morbidity and mor-

tality seem to be threefold,³ and several studies indicate that age is a major risk factor influencing outcome after surgery. Studies in Veteran Affairs medical centers of patients undergoing abdominal aortic aneurysm repairs show that patients older than 80 yr had a more than twofold higher mortality.⁴ In these studies, the effects of anesthetic techniques on perioperative outcomes have not been separated from the effects of surgical stress and are worth examining in future studies.

Need for Comprehensive, Long-term Outcome Measures in Anesthesia

The determination of outcomes has become refined in recent years. Strong methodologies, including randomized trials and the use of reliable and valid measures, contribute to our expanding knowledge of the potential benefits and risks of surgery, particularly in vulnerable populations such as the elderly. In this group of patients, the presence of immediate postoperative deficits in cognitive function provokes a question of the permanency and duration of these deficits. Permanent cognitive dysfunction after surgery is of special concern, given the impact these deficits have on all areas of function and, ultimately, the individual's ability to live independently.

The acute effects of anesthetic drugs on cognition and psychomotor functioning are well documented, but the long-term effects of these drugs seem minimal.⁵ Among the elderly, significant transient cognitive dysfunction often occurs up to 1 week after surgery, but longer-term impairments are less common.⁶⁻⁷ A consistent exception occurs after cardiopulmonary bypass: neuropsychological declines, both short- and long-term, occur frequently in older adults.⁸ Because intraoperative hypotension is associated with greater cognitive decline after coronary artery bypass surgery,⁹ the possibility that hypotensive anesthesia during hip replacement may induce some degree of cognitive decline is an important issue to investigate. Williams-Russo *et al.*² used sophisticated measures of cognitive functioning to examine the

This Editorial View accompanies the following article: Williams-Russo P, Sharrock NE, Mattis S, Liguori GA, Mancuso C, Peterson MG, Hollenberg J, Ranawat C, Salvati E, Sculco T: Randomized trial of hypotensive epidural anesthesia in older adults. *ANESTHESIOLOGY* 1999; 91:926-35.

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potential short- and long-term impact of hypotensive anesthesia. The tests were carefully selected to measure major domains of function—language, psychomotor speed and attention, and memory—in elderly patients across time. These widely used neuropsychological tests are performance-based rather than subjective and show excellent psychometric properties, including test-retest stability and validity. The strength of the study design, including the range of sensitive measures, the size of the sample, the elevated risk of the population, and longitudinal assessments, increases confidence in their conclusion.

Anesthetic Considerations in the Elderly

The anesthetic treatment of elderly patients presents special challenges that relate to the physiologic process of aging, the numerous coexisting age-related diseases, and the variety of pharmacologic agents that are often prescribed to treat chronic ailments.¹⁰ It has been suggested that, as part of the “normal” aging process, most organ systems lose approximately 1% function per year, beginning at approximately age 30. However, more recent studies suggest considerable individual variability in these declines. Studies suggest that the hallmark of aging is not necessarily decrements in resting level of performance, but in the lack of functional reserve and inability of the endocrine and cardiovascular systems to respond to external stress. Aging organ systems may not have the functional reserve to meet with the increased demands associated with the stress of surgery. In addition to the well-known physiologic changes in the cardiovascular, renal, and pulmonary systems associated with aging, age-related changes occur in cognitive abilities, particularly memory and speed of information processing. It is encouraging to note in the study by Williams-Russo *et al.*² that older adults tolerated the stresses of anesthesia and hypotension with complication rates comparable to normotensive anesthesia.

Balancing Act

The advantages of any anesthetic technique need to be balanced against the associated risks. For example, with hypotensive anesthesia, the advantages of reduced blood loss need to be balanced with the possibility of decreased cerebral perfusion and subsequent cognitive impairment. Several studies suggest a connection between low blood pressure and increased mortality in people

older than 75 yr. In addition, blood pressure levels show a complicated relationship with cognitive impairment. Elevated rates of cognitive decline have been associated with both low and high blood pressures,¹¹ with the pattern of decline depending on the nature of the blood pressure change with age.¹² Among the elderly, orthostatic hypotension has been shown to be a risk factor for cognitive decline.^{13,14} The lack of any short- or long-term cognitive impairment in the study by Williams-Russo *et al.*² with the use of hypotensive epidural anesthesia is encouraging, suggesting the safety of these transient episodes of low blood pressure.

Cerebral blood flow distribution during hypotension may vary depending on the technique used. For example, hemorrhage and trimethaphan uniformly decreased cerebral blood flow in most tissues. In contrast, nitroprusside-induced hypotension maintains regional blood flow in cortical and telencephalic regions.¹⁵ Thus, the effects of different hypotensive techniques on cerebral blood flow and cognition may not necessarily be similar.

Caution in Generalizing Conclusions of the Study

There are certain aspects of the study by Williams-Russo *et al.*² that may limit the generalizability of their conclusions. The authors excluded patients with significant carotid stenosis or valvular heart disease. In addition, the patient's hemodynamic status was monitored invasively with arterial and central venous lines, and the hypotensive epidural anesthesia was accompanied by a continuous infusion of low-dose epinephrine. In an earlier study, Sharrock *et al.*¹⁶ demonstrated that low-dose epinephrine infusion preserved cardiac output during hypotensive epidural anesthesia in elderly patients. Hence, hypotensive anesthesia in the elderly using other techniques may not be equally safe and needs to be confirmed with additional studies.

In summary, this study confirms that age alone is not a contraindication to hypotensive anesthesia. Few cardiovascular, renal, and thromboembolic complications and no declines in cognitive function were found in an elderly at-risk population. Anesthesiologists have focused their attention mostly on immediate perioperative outcomes, particularly those related to organ function and mortality. The careful longitudinal follow-up performed by Williams-Russo *et al.* that extended well beyond the perioperative period is worth emulating in future studies.

Srinivasa N. Raja, M.D.

Department of Anesthesiology and Critical Care Medicine
sraja@welchlink.welch.jhu.edu

Jennifer A. Haythornthwaite, Ph.D.

Department of Psychiatry and Behavioral Sciences
The Johns Hopkins University School of Medicine
Baltimore, Maryland 21287
jhaythor@welchlink.welch.jhu.edu

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Fast Tracking into the New Millennium***An Evolving Paradigm***

AS the new millennium approaches we can reflect with pride on advances in cardiac surgery and anes-

This Editorial View accompanies the following article: Wong DT, Cheng DCH, Kustra R, Tibshirani R, Karski J, Carroll-Munro J, Sandler A: Risk factors of delayed extubation, prolonged length of stay in the intensive care unit, and mortality in patients undergoing coronary artery bypass graft with fast-track cardiac anesthesia: A new cardiac risk score. *ANESTHESIOLOGY* 1999; 91:936-44.

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thesia. Many of us will focus less on the wonder of cardiac surgery and more on the question: "How did things change so fast and when will they stop?" The issues at hand are "whether all patients should be *forced* onto the fast track (FT)" and "whether FT is safe and effective." Proving this in an era of evolving technology and economic competition is difficult. The prospective study by Wong *et al.*¹ delineates "risk factors" for delayed extubation, prolonged length of stay (LOS) in the intensive care unit (ICU), and 30-day mortality in 885 patients undergoing coronary bypass graft (CABG), all treated on the FT pathway, and provides additional evidence that FT is "safe and effective" *enough*. The use of this qualifier may seem irreverent. However, the FT pathway is based on a

volatile mix of economics, science, and human interactions. Fortunately, for most patients, FT has *contributed* to modest goals without appreciable impact on patient safety, facilitating a substantial reduction in hospital LOS over the past decade.²

Fast Tracking and Economics

The history of the FT pathway is economic in origin. Many credit a single hospital in Southern California with an aggressive strategy to “capture” the growing Health Maintenance Organization market *via* deeply discounted rates for CABG in the mid-1980s, increasing surgical volume from 250 in 1985, to 1,300 in 1989. Krohn *et al.*³ reported on 240 patients who underwent surgery between 1984 and 1986. Their approach included early extubation, rapid mobilization, fluid restriction, and steroid administration. The median postoperative LOS was 4 days, in-hospital mortality was 2%, and the 6-month readmission rate was only 2.5%. This report was very influential in the spread of FT. However, Anders⁴ purported a “dark lining,” given steadily increasing Medicare mortality rates at that center, suggesting adverse effects on quality of care.

By the early 1990s, Health Maintenance Organizations were now the economic paradigm for non-Medicare patients. Simultaneously, the federal government moved to contain escalating Medicare costs. The Medicare Participating Heart Bypass Center Demonstration, conducted between 1991 and 1996 at seven hospitals agreeable to a single global discounted rate for CABG, saved an estimated \$50.3 million in 5 yr. The executive summary documents attempts to capture market share, realign financial incentives, and reduce costs and LOS by retooling processes of care.⁵ LOS and short- and long-term mortality all declined annually, despite increased severity of case mix. In-hospital complications increased marginally.

Our medical system remains expensive (\$1,092 billion in 1997, or 13.5% of the gross national product).⁶ Medicare costs for CABG have increased from \$2.8 billion in 1990 to \$7.3 billion in 1996, whereas procedures increased only 40% to 180,000. Although spending has declined (only 4.8% increase in 1997), it is projected to double over the next decade. Thus, the pressure to curtail costs will continue indefinitely.

Associations of Clinical Factors with Timing of Extubation

The series by Wong *et al.*¹ is the largest prospective, observational cohort analysis in which all patients undergoing CABG were managed on a FT pathway with the intention to extubate as soon as possible. Their findings are similar to our earlier retrospective series that documented a significant contribution of intraoperative process factors over preoperative risk factors alone in determining time to extubation.^{7,8} The data of Wong *et al.* extend these observations to ICU LOS as well.

The frequency of several variables associated with operative mortality is several percentage points lower than the Society of Thoracic Surgeons National Database for the corresponding period.⁹ Most notable are female gender, emergency surgery, and reoperation. The latter is greater still in many tertiary referral centers in the United States (*i.e.*, > 20% at the Cleveland Clinic¹⁰) and in Veterans hospitals (10%).¹¹ Mean patient age is several years younger. Age remains a complex risk factor with regard to mortality and resource consumption.¹² However, most studies verify that elderly patients emerge more slowly from anesthesia, are more sensitive to sedation, and are less likely to be extubated early. The lower risk profile of this series may influence its generalizability. Case volume must be considered because, in general, efficiency increases with volume.¹³ Because many U.S. centers are low volume, extrapolation from this “efficient” high-volume center may be problematic.

Logistic regression was used to model associations with delayed extubation, prolonged ICU LOS, and mortality. A battery of variables was considered; many are defined, but some are not, which may account for the surprising (albeit weak) finding relating atrial arrhythmia to delayed extubation. Atrial fibrillation increases resource consumption and morbidity (especially stroke). It has a peak incidence on postoperative day 2.¹⁴ In our experience, it does not usually have an independent effect on timing of routine extubation. Total LOS, arguably the most important consideration, is not considered. This is unfortunate given that hospitals use monitored settings differently, but “everyone has to leave sometime.” There may be thresholds in timing of extubation that correlate best with changes in total LOS.¹⁵ Hospital-specific factors are likely to be critical. Of the safety outcomes, mortality is certainly critical. However, its low frequency in this

Table 1. Reintubation with Fast-track Management

Reference	Design	No. of Patients	Study Period	% Reintubation
Wong <i>et al.</i> , 1999 ¹	P, O	885	1995	1.6
Engoren <i>et al.</i> , 1999 ¹⁹	R, O	1,000	1994–5	3
Rady and Ryan, 1999 ²⁰	R, O	11,330	1993–6	6.6
London <i>et al.</i> , 1997 ⁷ , 1998 ⁸	R, O	559 (PreFT: 255; FT: 304)	1992–5	PreFT: 6.3; FT: 5.0 (0.3 emergent)
Plümer <i>et al.</i> , 1998 ²¹	P, O	228	1996–7	0.8
Reyes <i>et al.</i> , 1997 ²²	P, RD	121 early, 151 overnight	1994–5	5.8 vs. 1.3
Cheng 1996 ¹⁷	P, RD	51 early	NA	1.9
Habib <i>et al.</i> , 1996 ¹⁸	R, O	492	1994	2.8 (<8 h), 3.5 (>8 h)
Arom <i>et al.</i> , 1995 ¹⁷	R, O	645	1993	<1 (<12 h), <1 (>12 h)

FT = fast track; P = prospective; O = observational; RD = randomized; PreFT = before fast track; NA = not available.

study limits statistical modeling. The c-index of 0.66 is less than values reported by large database studies (approximately 0.75).¹⁶ However, the factors identified (female gender, emergency surgery, and poor left ventricular function) are consistent with larger reports.¹⁶ Female gender has also been associated with longer postoperative ventilation^{1,17,18} and LOS.¹²

Of particular interest is the frequency of reintubation. Table 1 lists its frequency in several studies.^{1,8,17–21} Variation is related to the cohort and institution (*i.e.*, tertiary referral centers,²⁰ valve surgery,^{8,19,20} *etc.*), the frequency of pulmonary comorbidity,⁸ or peculiar anesthesia techniques.²² The predictors of reintubation include patients with prolonged initial ventilation, consistent with a perioperative lack of cardiopulmonary reserve.^{19,20}

Readmission, either back to the ICU or after discharge, is not considered. There are little data in the literature on ICU readmission, and it is likely sensitive to hospital-specific practices. Although postdischarge readmission is difficult to track, reported data vary. One center recently reported a 20.9% readmission rate, 49% to outside hospitals.²³ The authors of the latter study suggest this represents “cost shifting” spread out to other hospitals. Of note, the readmission rate was double in patients hospitalized ≥ 7 postoperative days. These rates are cause for concern.

An infrequent but feared complication is intraoperative recall. Dowd *et al.* recently published data from patients in this cohort.²⁴ Of 617 consecutive cases, recall occurred in only 2 patients (0.3%). This number is lower than those previously reported, suggesting that fast tracking is safe given near-continuous use of volatile agents.

The Evolving Face of Fast Tracking

The use of off-pump CABG *via* standard median sternotomy (OPCAB) or smaller limited incisions (MIDCAB) is increasing dramatically. Although long-term outcome data are not available, experience suggests shorter time to extubation and LOS. Risk stratification models will likely differ significantly from cardiopulmonary bypass-based models.²⁵

Reports from several centers have indicated LOS similar to that with MIDCAB using the conventional cardiopulmonary bypass approach. Ott *et al.*²⁶ reported a 29% discharge rate (of 100 patients) by postoperative day 3, whereas Walji *et al.*,²⁷ coining the phrase “ultra-fast tracking,” reported a 56% discharge rate (of 258 patients) by postoperative day 4, with 23% discharged by postoperative day 2. Readmission rates for the early cohorts, which included both younger and lower-risk patients than the later groups, were 3.9% and 5.6%, respectively, with no early mortality. These reports are controversial, and there is little reason not to believe that other centers will adopt similar approaches.

The Realities of Fast Tracking

Cardiac surgery remains torn between science and regulatory pressures. The latter will likely remain the driving force behind clinical practices. Fast tracking is here to stay. Early extubation is a pivotal component, one in which anesthesiologists play a major role. Evidence suggests that 50% to 75% of all patients undergoing primary CABG (and most valves) can and should be safely extubated by 10 h postoperatively.

Although Wong *et al.* provide valuable information

on variables associated with the timing of extubation, a respect for the consequences of "failure," and a dose of common sense based on preoperative risk, intraoperative course, and institution-specific factors must prevail. Even a large study may not paint an accurate picture, and sophisticated model validation strategies do not automatically permit generalization. Logistic regression allows excellent discrimination between predictors with a high frequency in the cohort. Factors of suspected clinical relevance, if not present above a certain frequency, will not be appreciated. Risk factors for respiratory morbidity in other surgical settings (*i.e.*, morbid obesity, abnormal airway anatomy, renal or hepatic insufficiency, neurologic disease) may be overlooked.

Despite the aforementioned caveats, the evidence suggests that early extubation facilitates a measurable reduction in ICU and total LOS in nearly all hospitals, regardless of organizational structure. Each hospital should measure the safety and efficacy of its FT program to avoid cost shifting or patient harm. FT is safe and effective enough. Regardless of our individual opinions, it seems that most organizations paying for this health care have already made their decisions.

Martin J. London, M.D.

Professor in Residence
Department of Anesthesia
University of California-San Francisco
Veterans Affairs Medical Center
San Francisco, California 94121
londonm@anesthesia.ucsf.edu

A. Laurie W. Shroyer, Ph.D., M.S.H.A.

Assistant Professor of Medicine
University of Colorado Health Sciences Center
Veterans Affairs Medical Center
Denver, Colorado 80220
laurie.shroyer@med.va.gov

Frederick L. Grover, M.D.

Professor of Surgery
University of Colorado Health Sciences Center
Veterans Affairs Medical Center
Denver, Colorado 80220
groverfc@aol.com

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The Importance of Professional Obligations

Nonpatient Care Obligations of Anesthesiologists

TO some observers, American medicine appears to have lost its moorings and is drifting aimlessly in an increasingly hostile environment. The article by Waisel¹ in this issue of *ANESTHESIOLOGY* may play a key role in reminding us of our core values and obligations, and by so doing reestablish the moral and ethical orientation necessary to guide our specialty into a new era of medicine.

How long has it been since you participated in a gathering of physicians in which the primary topic of conversation was science or clinical care? The distractions from our devotion to our patients are many, and they are real: a nation that demands more and better health care while allocating less money for its provision; a government that proclaims fraud and abuse in health

care to be rampant and tries to pit patients against physicians: third-party payers who try to amass market share to increase profits, not to improve outcomes; the swift introduction of a competitive business model into an industry inexperienced in competition; and the fragmentation of collegiality at a time when unity has never been more vital. It is little wonder, then, that physicians seem embittered and disillusioned as they struggle to maintain high standards of patient care as the entire health care system leaves one model behind for the next one, which remains undefined.

Waisel refreshingly and simply reminds us of the unique obligations that are incumbent on us as physicians and anesthesiologists. These obligations arise from our relationships with individual patients, who entrust their lives to strangers; with society, which has invested unprecedented resources in our education and the advancement of medical science; and with various communities, including our professional associates and the institutions in which we practice, the community of patients (locally, regionally, and nationally), and the greater anesthesiology community that created our current opportunities and now entrusts to our care the future of the specialty.

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The enormous trust and respect that society continues to accord physicians arises directly from our continued fulfillment of the obligations Waisel cites. In these times of uncertainty, anesthesiologists must be guided by our ethical principles and by our relentless commitment to placing patients' interests above our own.

It is the understanding of the centrality of ethical obligations and a selfless devotion to their fulfillment that distinguishes the professional from a proficient technician. Waisel's reminder of our nonpatient obligations is timely, instructive, and powerful.

John B. Neeld, Jr., M.D.

President, American Society of Anesthesiologists
Chair, Department of Anesthesiology
Northside Hospital
Atlanta, Georgia
jneeld@gaanes.com

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