Anesthesia and Maternal Mortality

Systematic national studies of anesthesia-related maternal mortality are sparse. Heretofore, anesthesiologists in the United States have relied primarily on the triennial Report on Confidential Enquiries into Maternal Deaths in the United Kingdom. These reports undoubtedly have provided the most comprehensive information regarding maternal mortality in any country in the world. The American Society of Anesthesiologists (ASA) Closed Claims Project has provided valuable information on the types and extent of obstetric injuries—both fatal and nonfatal—that have resulted in claims against anesthesiologists. However, the Closed Claims Project lacks a denominator, and, therefore, does not provide an estimate of the incidence of anesthesia-related maternal mortality.

In this issue of Anesthesiology, Hawkins et al. present results of the first national study of anesthesia-related maternal mortality in the United States. The study was performed in cooperation with the National Pregnancy Mortality Surveillance System, which is sponsored by the Centers for Disease Control and Prevention. Clinical epidemiologists reviewed copies of death certificates—and when available, birth certificates and fetal death records—for all identified pregnancy-related deaths between 1979 and 1990. Three obstetric anesthesiologists then reviewed the death certificates for those cases in which the epidemiologists had identified a possible relation to anesthesia. The authors acknowledged that these “vital records are often incomplete concerning the events surrounding the death.” Consequently, in some cases, they were unable to determine the method of delivery, the type of anesthesia, or the cause of death.

The authors then calculated case fatality rates for general and regional anesthesia. First, they determined the number of live births and cesarean sections for each year between 1979 and 1990. Then they estimated the number of general and regional anesthetics administered for cesarean section. These estimates were derived from the estimated percentages of general and regional anesthetics administered for cesarean section, as provided by anesthesiologists and obstetricians in national workforce surveys conducted in 1981 and 1992. The 1981 survey was used to estimate the number of general and regional anesthetics administered for cesarean section in the years 1979–1984, and the 1992 survey was used to provide a similar estimate for the years 1985–1990.

The major findings of the current study are as follows:

1. The anesthesia-related maternal mortality rate declined from 4.3 per million live births in the years 1979–1981 to 1.7 per million live births in the years 1988–1990.

2. The absolute number of maternal deaths involving general anesthesia has remained stable between 1979 and 1990. Airway problems represented the most frequent cause of death among women who died from a complication of general anesthesia. In contrast, the absolute number of maternal deaths that involved regional anesthesia has declined since 1984. Deaths resulting from regional anesthesia were almost evenly divided between local anesthetic toxicity and high spinal/epidural anesthesia. However, fewer deaths that resulted from local anesthetic toxicity were reported after 1984, when the Food and Drug Administration withdrew approval for epidural administration of 0.75% bupivacaine in obstetric patients.

3. The estimated rate of maternal death from complications of general anesthesia during cesarean section increased from 20.0 deaths per million general anesthetics in 1979–1984 to 32.3 deaths per million in 1985–1990. In contrast, the estimated rate of death from complications of regional anesthesia during cesarean section decreased from 8.6 per million regional anesthetics in 1979–1984 to 1.9 per million in 1985–1990.

4. The case fatality rate for general anesthesia was 2.3 times that for regional anesthesia in 1979–1984, increasing to 16.7 times that for regional anesthesia in 1985–1990.

These results will likely resonate with the views of most anesthesiologists who provide care for obstetric patients. Conventional wisdom holds that general anesthesia entails greater maternal risk than does regional...
anesthesia. Chadwick et al. observed that claims involving general anesthesia were associated more frequently with severe injuries and resulted in larger payments than did claims that involved regional anesthesia. In 1991-1993, all of the direct anesthetic deaths associated with cesarean section in the United Kingdom occurred in women who received general anesthesia. Nonetheless, the validity of the case fatality rates in the current study depends on two assumptions: (1) that the authors' methods were both highly sensitive and specific for identification of anesthesia-related maternal deaths (i.e., the numerator), and (2) that the authors have accurately proportioned the number of general anesthetics and regional anesthetics administered for cesarean section (i.e., the denominator).

Let us consider the methods used to calculate the numerator (i.e., the number of anesthesia-related maternal deaths). The authors acknowledged that not all maternal deaths are identified on death certificates, and that "as many as 37% of maternal deaths are missed due to underreporting on vital statistics records." In addition, some maternal deaths ascribed to amniotic fluid embolism or cardiac arrest of unknown etiology may have resulted from complications of anesthesia. Likewise, some maternal deaths from obstetric hemorrhage may have resulted from inadequate resuscitation by the anesthesia care provider; however, those deaths likely were not coded as anesthesia-related maternal deaths.

Unfortunately, all judgments in the current study were made without a review of the medical records because these records were unavailable. Therefore, the type of anesthesia (i.e., general vs. regional) was not identified in one of every five women who died. Likewise, the type of anesthesia was not identified in two of every five women whose cause of death was listed as cardiac arrest. The type of obstetric delivery (i.e., vaginal vs. cesarean) was not identified in one of every eight women who died.

The methods used to calculate the denominator (i.e., the estimated number of general and regional anesthetics) have at least three limitations. First, the validity of the survey data depends on the assumption that the respondents were representative of all obstetric anesthesia providers in the United States. Second, the collective estimates are only as accurate as the data provided by the individual respondents. It is likely that some respondents conscientiously reported accurate data from their respective hospitals. Others likely provided "off the cuff" estimates that may not have reflected actual practice. (In my experience, anesthesiologists often underestimate the use of general anesthesia for cesarean section.) Third, the two surveys suggested that the use of general anesthesia for cesarean section decreased from 41% in 1981 to 16% in 1992. Hawkins et al. used the 1992 figure to estimate the number of general anesthetics administered in 1985-1990. If one assumes there was a gradual, "straight line" rate of change, then the incidence of general anesthesia for cesarean section in 1985 was approximately 32% rather than 16%. Again, this would suggest that the authors underestimated the use of general anesthesia during the years 1985-1990. An underestimation of the number of general anesthetics administered in 1985-1990 would result in an overstatement of the relative risk of general anesthesia during those 6 years.

These limitations notwithstanding, the current study has good news and bad news. The good news is that the absolute number of regional anesthesia-related maternal deaths has decreased, despite the increased utilization of regional anesthesia for labor and cesarean section. The decrease in the number of regional anesthesia-related deaths provides tangible evidence of safer use of epidural and spinal anesthesia in obstetric patients. (The contribution of the ASA "Guidelines for Regional Anesthesia in Obstetrics" is unclear, given the fact that these guidelines were first approved in 1988.) Unfortunately, the number of general anesthesia-related deaths has not decreased, despite an apparent decrease in the use of general anesthesia for cesarean section, and despite the widespread use of pulse oximetry and end-tidal carbon dioxide monitoring during the latter half of the study. These results might logically provoke a two-fold response: (1) encourage greater use of regional anesthesia for cesarean section, and (2) improve safety for those patients who still require general anesthesia for cesarean section.

Some anesthesiologists fear that managed care will make it difficult for us to accomplish the former objective (i.e., greater use of regional anesthesia for cesarean section). Administration of epidural analgesia during labor facilitates the administration of epidural anesthesia for emergency cesarean section. Some anesthesiologists have maximized the use of regional anesthesia for cesarean section by providing round-the-clock, dedicated anesthesia staffing for the labor and delivery suite. Ironically, one decade ago, some obstetricians and hospitals had to persuade their anesthesiologists to provide anes-
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The care for obstetric patients. Currently, some obstetricians and third-party payers have decided they would prefer less of our services. They contend that epidural analgesia is expensive and often unnecessary, and that it results in an increased cesarean section rate, which results in additional cost. Consequently, even some large, tertiary care facilities are questioning whether they can continue to provide dedicated anesthesia staffing for the labor and delivery suite. Safety issues aside, most women want to remain awake for cesarean childbirth. I hope that fiscal constraints will not result in a step backward and greater use of general anesthesia for cesarean section.

What about those patients who refuse regional anesthesia or require general anesthesia for cesarean section? Why has the number of general anesthesia-related maternal deaths not decreased similar to the number of regional anesthesia-related maternal deaths? The ASA "Standards for Basic Anesthetic Monitoring"—first approved in 1986—now mandate the use of both pulse oximetry and end-tidal carbon dioxide monitoring during administration of general anesthesia for cesarean section. Why have these standards not resulted in a decrease in general anesthesia-related maternal mortality? Hawkins et al. suggested that general anesthesia may have been reserved primarily for high-risk patients (e.g., women with morbid obesity, hemorrhage, or coagulopathy). Some may argue that it will be difficult to reduce further the number of general anesthesia-related deaths in obstetric patients. As long as obstetricians continue to ask anesthesiologists to provide anesthesia for emergency cesarean section at a moment’s notice, it is unlikely we can reduce the general anesthesia-related mortality rate to zero. However, we should not assume there is no room for improvement in the safety of general anesthesia for obstetric patients. At least three recent developments provide reason for optimism: (1) publication of the ASA "Practice Guidelines for Management of the Difficult Airway"; (2) the availability of new tools (e.g., laryngeal mask airway, Combitube, Kendall Sheridan, Argyle, NY) for management of cases of failed intubation/failed ventilation, and (3) publication of the American College of Obstetricians and Gynecologists Committee Opinion, “Anesthesia for Emergency Deliveries.” This document reminds us of the hazards of general anesthesia, and it recommends early consultation with an anesthesiologist and early administration of epidural analgesia in patients at high risk for complications of general anesthesia. Both anesthesiologists and obstetricians should note those demographic and personal characteristics associated with an increased risk of maternal death, including: (1) non-white ethnicity, (2) poor socioeconomic status, (3) obesity, and (4) age greater than 35 years. Non-white and poor parturients are especially vulnerable to reductions in healthcare spending by government agencies and other third-party payers.

Meanwhile, healthcare providers and third-party payers in the United States should give attention to the latest data on maternal mortality in the United Kingdom. After 12 years of a steady decrease in the anesthesia-related maternal mortality rate, the most recent report noted an increase in the anesthesia-related maternal mortality rate for the years 1991-1993 in the United Kingdom. Substandard care—often performed by inexperienced personnel—was identified in all but one of the anesthesia-related maternal deaths. Let us resolve that we will not allow a similar reversal to occur in the United States.

David H. Chestnut, M.D.
Alfred Habeeb Professor and Chair of Anesthesiology
Professor of Obstetrics and Gynecology
University of Alabama at Birmingham
Jefferson Tower, Room 920
619 South 19th Street
Birmingham, Alabama 35233-6810
Electronic mail: dchestnut@ms.jt.anes.uab.edu/

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