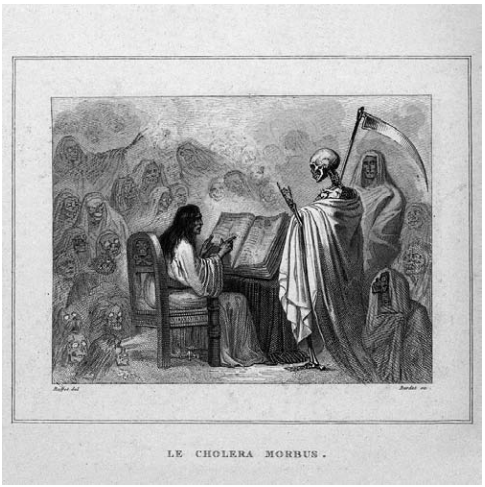
Anesthesiologist as Epidemiologist

Insights from Registry Studies of Obstetric Anesthesia–related Complications

Brian T. Bateman, M.D., M.Sc., Lawrence C. Tsen, M.D.

CME This article has been selected for the Anesthesiology CME Program. Learning objectives and disclosure and ordering information can be found in the CME section at the front of this issue.

IN the summer of 1853, cholera plagued the city of London despite the best efforts of city officials and the medical establishment, who blamed the epidemic on the inhalation of foul air ("miasma").[1] John Snow, M.D. (1813–1858; London, England), a general practitioner seasoned in the use of anesthetics, undertook an epidemiological study of mortality records at the General Registry Office to question this theory. Snow believed that if the inhalation of odors was truly the cause of cholera, those in closest proximity to their source would be most affected, as is the case with anesthetic gases. Snow discovered that the preponderance of cholera-related deaths did not occur among tradespersons working in malodorous environments (*e.g.*, slaughterhouses) but rather among people in the vicinity of the Broad Street water pump. His presentation to the St. James Parish governors resulted in the pump handle being removed, and the epidemic of cholera subsided.



"Anesthesiologists are uniquely qualified to assist in the reduction of obstetric-related mortality and morbidity."

Snow's example demonstrates the power of careful epidemiologic investigation informed by clinical expertise and experience. Today, more than one and a half centuries later, anesthesiologists are only beginning to fully embrace epidemiologic tools to advance the practice of our specialty. The recent establishment of the Anesthesia Quality Institute Clinical Outcomes Registry (National Anesthesia Clinical Outcomes Registry*) and the Multicenter Perioperative Outcomes Group† has occurred as a result of broadening interest in the use of large observational studies to define optimal approaches to anesthesia care.

Acknowledging the importance of epidemiologic data to the practice of obstetric anesthesia, D'Angelo *et al.*[2] established a **s**erious **co**mplications **re**pository (SCORE) on behalf of the Society for Obstetric Anesthesia and Perinatology. The investigators reviewed and adjudicated complications submitted on standardized forms from 30 centers within the United States, accounting for more than 307,000 deliveries over 5 yr. Given its size and the care with which its cases were compiled, the study represents the most definitive account of complications related to obstetric anesthesia in the United States published to date.

The SCORE data regarding anesthesia complications are generally reassuring, but the study also serves to highlight areas of concern where clinical and research attention should be focused. There was a very low incidence of many serious complications related to anesthetic interventions, including epidural hematoma (1: 250,000), epidural abscess/meningitis (1: 60,000), and serious neurological injury (1:35,000). There were no reported cases of serious aspiration or of hypoxic arrest secondary to a lost airway. However, the incidence of high spinal blockade was higher than what might have been predicted (1:4,000); 20% of these occurred in the

Image: An allegory of cholera mortality. Denis Auguste Marie Raffet, c.1832: Wellcome Library, London, United Kingdom.

Corresponding article on page 1505.

Accepted for publication February 24, 2014. From the Department of Anesthesia, Critical Care, and Pain Medicine, Massachusetts General Hospital, and Division of Pharmacoepidemiology and Pharmacoeconomics, Department of Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts (B.T.B.); and Department of Anesthesiology, Perioperative, and Pain Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts (L.C.T.).

* Available at: http://www.aqihq.org. Accessed April 4, 2014.

† Available at: http://mpog.med.umich.edu. Accessed April 4, 2014.

 Anesthesiology 2014; 120:1311-2

setting of a spinal anesthetic after failed epidural blocks and 25% occurred due to unrecognized spinal catheters.

Although the data regarding anesthesia complications were favorable overall, the same cannot be stated for maternal mortality. Maternal death occurred in approximately 1 in 10,000 deliveries, which is consistent with nationwide estimates for the United States. Hemorrhage, considered a largely preventable source of severe maternal morbidity and mortality, was the leading cause of arrest and of death, accounting for about a third of both outcomes.

These findings highlight concerning trends among the obstetric population. The maternal mortality rate in the United States is among the highest in the developed world and has the unusual distinction of increasing over the past decade.[3] Moreover, the Centers for Disease Control and Prevention has estimated a 75% increase in the incidence of severe maternal morbidity between 1998 and 2009, an outcome that now occurs in approximately 1% of deliveries.[4] These high and increasing rates of maternal mortality and morbidity have prompted the obstetric community,[5] and even human rights organizations,[6] to articulate a call to action.

Anesthesiologists are uniquely qualified to assist in the reduction of obstetric-related mortality and morbidity. However, this will require an expansion of the role to which we frequently limit ourselves. Historically, our focus as clinicians has been the provision of obstetric anesthesia and analgesia, with incidental responses to critical events. Just as we are striving generally in our field to embrace the role of "perioperative" physician,[7] we should assume the role of "peridelivery" physician, drawing upon our operative and critical care experience in managing medically complex and unstable patients. Our expertise allows us to make substantial contributions to the care of high-risk or critically ill parturients. Ultimately, our participation should improve patient outcomes and the trajectory of obstetric mortality and morbidity.

A successful transition to the role of "peridelivery" physician will also require that we conduct research focused on obstetric questions. Basic research into the pathophysiology underlying the major obstetrical diseases and complications and observational and clinical trials aimed at defining the optimal management of these conditions are much needed. Already, anesthesiologists have taken up this mantle. For example, anesthesiologists have made significant contributions to the appropriate use of oxytocin for the prevention and treatment of uterine atony.[8,9] The substance and prioritization of our efforts should be refined by examining large data sets such as the Centre for Maternal and Child Enquiries registry in the United Kingdom and, now, the SCORE project in the United States.

John Snow[10] extended his influence with his seminal treatise "On the Inhalation of the Vapour of Ether in Surgical Operations" and his provision of chloroform to Queen Victoria for childbirth. Yet his additional role as epidemiologist may have ultimately served humanity most. Considered a luminary within both anesthesia and epidemiology, he combined clinical experience and careful observational study to revolutionize the approach to an important public health issue. D'Angelo *et al.*, in constructing and analyzing the SCORE registry, carry on the tradition of anesthesiologist as epidemiologist.

Competing Interests

Drs. Bateman and Tsen are members of the Society of Obstetric Anesthesia and Perinatology (Milwaukee, Wisconsin).

Correspondence

Address correspondence to Dr. Bateman: bbateman@partners.org

References

1. Johnson S: The Ghost Map: The Story of London's Most Terrifying Epidemic—And How It Changed Science, Cities, and the Modern World. New York, Riverhead Books, 2006
2. D'Angelo R, Smiley RM, Riley ET, Segal S: Serious complications related to obstetric anesthesia: The Serious Complication Repository Project of the Society of Obstetric Anesthesia and Perinatology. Anesthesiology 2014; 120:1505–12
3. Hogan MC, Foreman KJ, Naghavi M, Ahn SY, Wang M, Makela SM, Lopez AD, Lozano R, Murray CJ: Maternal mortality for 181 countries, 1980–2008: A systematic analysis of progress towards Millennium Development Goal 5. Lancet 2010; 375:1609–23
4. Callaghan WM, Creanga AA, Kuklina EV: Severe maternal morbidity among delivery and postpartum hospitalizations in the United States. Obstet Gynecol 2012; 120:1029–36
5. D'Alton ME, Bonanno CA, Berkowitz RL, Brown HL, Copel JA, Cunningham FG, Garite TJ, Gilstrap LC III, Grobman WA, Hankins GD, Hauth JC, Iriye BK, Macones GA, Martin JN Jr, Martin SR, Menard MK, O'Keefe DF, Pacheco LD, Riley LE, Saade GR, Spong CY: Putting the "M" back in maternal-fetal medicine. Am J Obstet Gynecol 2013; 208:442–8
6. Deadly Delivery: The Maternal Health Care Crisis in the USA. London, UK, Amnesty International, 2010
7. Warner MA: Who better than anesthesiologists? The 44th Rovenstine lecture. Anesthesiology 2006; 104:1094–101
8. Carvalho JC, Balki M, Kingdom J, Windrim R: Oxytocin requirements at elective cesarean delivery: A dose-finding study. Obstet Gynecol 2004; 104(5 Pt 1):1005–10
9. Balki M, Erik-Soussi M, Kingdom J, Carvalho JC: Oxytocin pretreatment attenuates oxytocin-induced contractions in human myometrium *in vitro*. Anesthesiology 2013; 119:552–61
10. Snow J: On the Inhalation of the Vapour of Ether in Surgical Operations: Containing a Description of the Various Stages of Etherization, and a Statement of the Result of Nearly Eighty Operations in which Ether Has Been Employed in St. George's And University College Hospitals. London, UK, John Churchill, 1847