Mitigating Harm to Both Patient and Provider: Anesthesia Cases from Labor and Delivery

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Case report: healthy patient presented for scheduled cesarean delivery because of breech position; spinal anesthetic planned; senior resident placed anesthetic while speaker began phenylephrine infusion; speaker realized she had connected oxytocin (eg, Pitocin, Syntocinon) instead of phenylephrine; speaker turned off and disconnected oxytocin; resident finished spinal; patient experiencing tetanic contraction, impairing blood flow and oxygen delivery to fetus; fetal heart rate 60; immediate cesarean delivery necessary; baby fine; speaker administered nitroglycerin to reverse effects of oxytocin, causing uterine atony after delivery; methylergonovine (Methergine) required for treatment; umbilical artery pH 6.98; literature suggests pH < 7 associated with increased incidence of ischemic encephalopathy, intraventricular hemorrhage, and cerebral palsy identified soon after delivery

Root-cause analysis: multiple infusions on one pole; oxytocin not running through pump

Changes in practice: tubing for phenylephrine and oxytocin visually different; oxytocin no longer on pole at start of procedure; tubing coiled and taped to bag to prevent tangling

Metacognition: science of thinking about thinking; articles have applied it to cognitive processes in anesthesia care

Bias: anchoring bias — focusing on one thing to the exclusion of others; availability bias — certainty about diagnosis because of emotional attachment, usually because of past experience; confirmation bias — only seeking or acknowledging data that support assumed diagnosis; framing bias — occurs when thinking affected by leading aspects of initial presentation; ideas, assumptions, or conclusions affect assessment; eg, erroneously concluding patient’s symptoms result of personality traits instead of medical condition

Heuristics: mental shortcuts and pattern recognition; as training and experience increase, ability to interpret data and focus on relevant data improves; however, may lead to failure to recognize abnormal causes of normal patterns

Errors: inevitable, particularly by experts; Dr. Itiel Dror examines how people make choices with little data that must be interpreted quickly; cognitive errors occur among experts in every domain; Dror refers to this as “paradox of expertise”; he suggests spending less energy attempting to completely eliminate errors and instead focusing on mitigation of harm; simulation valuable because emotional response to experiences or simulations allows longer retention of lessons learned

Minimizing harm to patient: call for help; treat complications; disclosure and apology — anesthesiologist rarely first to disclose error; conversations ideally take place with surgeon present, but often occur after surgeon has spoken with patient; in case example, speaker explained need for immediate delivery to patient and helped mother to understand why tempo in OR changed; reinforced idea of taking responsibility and commitment to continued conversation; provided opportunity to reassure mother about condition of baby

Minimizing harm to selves: provider “second victim” when adverse events occur despite best intentions; culture of OR at speaker’s hospital facilitated asking for help

Quality assurance (QA) process: supportive QA process exists at speaker’s institution; safety report filed; event documented in medical record; disclosure conversation also documented in record

Disclosure process: disclosure ongoing process; in case example, patient had no questions at time of initial disclosure; husband concerned when told about event and asked about health of baby; new questions in recovery room; continued disclosure conversations during remaining course of patient’s hospitalization; additional questions arose after family and neighbors notified of event, providing additional opportunities for reassurance, education, and strengthening commitment to patient’s safety and good outcome for baby

Debriefing: important component for minimizing harm to self and optimizing ability to care for subsequent patients; speaker, intern, surgeon, nurses, and anesthesia team immediately met and discussed event; discussions before QA committees also interdisciplinary; provided opportunity to discuss strategies for improvement

Peer support program: in speaker’s department; ~25 people identified by colleagues as good listeners (supportive and understanding); they underwent training with psychologist to become peer counselors; training included posttraumatic stress disorder and cognitive and emotional processes (eg, lack of sleep, invasive ideas, recurring ideas, replaying of events); peer supporters trained to counsel clinicians; peer supporter is immediately deployed after critical event has affected clinician; coaching offered for disclosure and apology

Safe workplace: create safe workplace that permits necessary risks and mitigates harm; dependent upon culture of transparency

Electronic QA database at speaker’s institution: QA page required for every use of anesthetic before encounter closed or bill sent; includes any adverse events; QA report

Educational Objectives

The goals of this program are to improve the management of anesthesia errors and the quality of pregnancy-related analgesia. After hearing and assimilating this program, the clinician will be better able to:

1. Mitigate harm to patients resulting from errors in the administration of anesthesia.
2. Implement institutional practices that facilitate a culture of transparency.
3. Provide appropriate treatment modalities for labor analgesia.
4. Optimize the administration of phenylephrine for the treatment of hypotension after spinal anesthesia.
5. Cite current literature addressing the use of opioids by pregnant women.

Faculty Disclosure

In adherence to ACCME Standards for Commercial Support, Audio Digest requires all faculty and members of the planning committee to disclose relevant financial relationships within the past 12 months that might create any personal conflicts of interest. Any identified conflicts were resolved to ensure that this educational activity promotes quality in health care and not a proprietary business or commercial interest. For this program, members of the faculty and planning committee reported nothing to disclose.

Current Trends and Controversies in Obstetric Analgesia

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Remifentanil
Case report: healthy woman aged 24 yr, gravida 2 (G2) para 1 (P1; with intrauterine fetal demise at 31 wk); BMI 29, Mallam- pati 2 (laboratory values within normal limits); patient given oral opioids by midwife and later examined by anesthesiologist; patient-controlled analgesia (PCA) started with remifentanil using standard settings (40 μg bolus with lockout 2 min, no basal rate, 4 hr limit 5 mg); anesthesiologist remained with patient for 15 min and 5 boluses; patient continued use of nitrous oxide and oxygen (Entonox, Nitronox) with contractions; no desaturation; patient’s mother called for help 15 min later; patient found unresponsive; cardiopulmonary resuscitation initiated for cardiac arrest; masseter spasm prevented intubation; patient ventilated by mask; perimortem cesarean delivery performed in room and patient taken to operating room for abdominal closure; patient made full recovery with no neurologic sequelae; examination of pump indicated patient received only 3 additional boluses; no evidence of pump malfunction

Advantages: considered good labor analgesia in early 2000s; thought to be better than nitrous oxide or fentanyl administered by intravenous PCA for first hr; fast onset and short half-life; quickly metabolized by plasma esterases, so should not affect baby; patient able to self-administer by PCA; quickly metabolized in fetal bloodstream; no negative neonatal outcomes

Disadvantages: pain relief inferior to neuraxial techniques; difficult for patients to properly time administration; may experience episodes of apnea; appropriate dosage and means of administration unclear and may vary among patients; background infusion increases risk; unpredictability biggest risk besides apnea

Monitoring: requires constant monitoring during administration, with pulse oximetry at minimum; some advocate for capnography, but availability limited in labor and delivery; constant patient supervision not practical

Effectiveness: less effective than epidural analgesia; Liu et al (2014) performed meta-analysis of 5 randomized controlled trials comparing remifentanil with epidural; background infusion did not improve analgesia; no differences observed in nausea and vomiting, pruritus, or umbilical artery pH between remifentanil and epidural; confidence intervals wide, so no definite conclusions drawn; opioids effective for visceral pain but less effective for somatic pain (second stage of labor primarily involves somatic pain); speaker does not consider remifentanil good choice for labor analgesa

Nitrous Oxide
Case report: woman aged 28 yr, G2P1, at 40 wks presents in labor; dilated 7 cm and uncomfortable; platelet count 55; Jehovah’s Witness with documented refusal of blood products

Background: colorless, sweet-smelling nonflammable gas used for inhaled anesthesia and analgesia; low metabolism; mechanism of action N-methyl-D-aspartate inhibition; typically administered in 50/50 mix with oxygen; may be premixed (Entonox) or mixed with blender device (Nitronox); typically self-administered by patient

Likis et al (2014): systematic review of 58 articles on effectiveness of nitrous oxide; only 2 articles considered good quality because others demonstrated bias, inconsistent findings, and differing methodologies

Advantages: easy for patient to use; low potency and solubility; rapid onset and recovery; patient able to self-administer; overdose unlikely; provides anxiolytic effect; preserves mobility; noninvasive and typically inexpensive; no additional monitoring required

Disadvantages: risk for hypoxia (low); quality of pain relief much less than that with neuraxial technique

Effect on fetus: no demonstrated differences in Apgar scores, but studies not long-term

Effectiveness: studies assessed pain differently, so difficult to draw conclusions; same difficulties with measuring patient satisfaction; no uniform measurements in studies of adverse effects; safety and efficacy largely unknown

Phenylephrine

Background: used for hypotension after spinal anesthesia; phenylephrine replaced ephedrine for this indication; timing and method of delivery debated; improves hypotension and maternal symptoms; does not harm fetus

Siddik-Sayyid et al (2014): compared boluses alone with variable-rate infusion with rescue boluses; patients received 15 mL/kg crystalloid and were randomized to phenylephrine or saline infusion; maternal systolic blood pressure maintained within 20% of baseline with rescue boluses; hemodynamics
more stable in patients receiving phenylephrine infusion; also less hypotension, nausea, and vomiting; no effects on fetal outcomes; concluded phenylephrine infusion more effective for maternal symptoms compared with boluses alone

**Transversus Abdominis Plane (TAP) Block**

**Case report:** woman aged 32 yr, G2P2, in postanesthesia care unit after emergency cesarean delivery for placental abruption; received spinal anesthesia with no intrathecal opioids; persistent pain despite PCA and ketorolac (Toradol)

**TAP block:** regional block used for postoperative analgesia in procedures involving lower abdominal wall; ultrasonography guided; studies have not shown benefits; some case reports of delayed toxicity; speaker reports observing clinical benefits, but literature currently not recommending use

**Opioids**

**Case report:** woman aged 29 yr, G1 at 24 wk; presents to pain clinic with unrelenting back pain

**Desai et al (2014):** 7-yr study investigated women enrolled in Medicaid; of 1.1 million women, 21% filled prescription for opioid at some point during pregnancy, most commonly codeine or hydrocodone; average one prescription for 5 days of use; significant regional variation

**Bateman et al. (2014):** similar study with privately insured women; of 500,000 women, 14% given opioid at some point during pregnancy, most commonly codeine hydrocodone; opioids after cesarean delivery not included; 10% of prescriptions associated with hospital admission; average one prescription for 5 days; significant regional variation; usage highest in South (Southeast) in both studies; no difference in use by trimester in either study; back pain most common reason for prescription (40%); other common complaints included abdominal pain, migraines, and joint pain

**Limitations of Desai and Bateman:** prescribed opioids not necessarily taken; studies did not include illicit opioids, methadone from clinics, or opioids received as inpatients; gestational ages estimated

**Maeda et al (2014):** used same data to assess outcomes; found opioid use increasing; maternal opioid use associated with increased risk for maternal death, cardiac arrest, and intracerebral growth restriction; between 2-fold and 4-fold increase in risk overall

**Important considerations:** pain common during pregnancy; low back pain present in 66% of pregnant women, pelvic pain in 20%; in Bateman study, 10% had surgery, and 1% were chronic opioid users before pregnancy, so 99% eligible for other therapies; reasons for regional variations unclear

**Suggested Readings**


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**Acknowledgments**

Dr. Pian-Smith spoke at the 66th Annual Postgraduate Symposium on Anesthesiology; presented by the University of Kansas Medical Center, Department of Anesthesiology and the University of Kansas Medical Center Continuing Education, and held April 1-3, 2016, in Kansas City, MO. For information on other CME opportunities presented by the University of Kansas Medical Center, please visit kumcce.ku.edu. Dr. Elterman spoke at the Texas Society of Anesthesiologists Annual Meeting, presented by the Texas Society of Anesthesiologists and held September 10-13, 2015, in San Antonio, TX. For information on upcoming CME meetings from The Texas Society of Anesthesiologists, please visit tsa.org. The Audio Digest Foundation thanks the speakers and the sponsors for their cooperation in the production of this program.

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**Estimated time to complete the educational process:**

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<th>Activity</th>
<th>Time Required</th>
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<tr>
<td>Review Educational Objectives</td>
<td>5 minutes</td>
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<td>Take pretest</td>
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<td>Listen to audio program</td>
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<td>Review written summary and suggested readings</td>
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<tr>
<td>Take posttest</td>
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1. Metacognition refers to which of the following?
   (A) Mental shortcuts and pattern recognition
   (B) Process of interpreting incoming data
   (C) Thinking about thinking **
   (D) Social information processing

2. Which of the following types of bias refers to certainty about a diagnosis because of emotional attachment caused by past events?
   (A) Anchoring bias
   (B) Availability bias **
   (C) Confirmation bias
   (D) Framing bias

3. Which of the following is one of Dr. Itiel Dror’s concepts about cognitive errors among experts?
   (A) Efforts should be made to eliminate errors entirely
   (B) Mitigation of harm should be the primary focus **
   (C) Simulation is of little practical use for training
   (D) Errors can be dramatically reduced by attaining high levels of expertise

4. In their training, counselors in the peer support program at Massachusetts General Hospital are taught about all the following, EXCEPT:
   (A) Posttraumatic stress disorder
   (B) Dealing with invasive and recurring ideas
   (C) How to minimize liability from errors **
   (D) How to talk to people effectively

5. Which of the following is true about the electronic quality assurance (QA) database used at Massachusetts General Hospital?
   (A) A QA report is required for every use of an anesthetic
   (B) A QA report is included in the patient’s medical record
   (C) QA reports are available to the public
   (D) Only a few qualified individuals can file safety reports

6. All the following are disadvantages of using remifentanil for labor analgesia, EXCEPT:
   (A) Inferior to neuraxial techniques for pain relief
   (B) Patient may experience episodes of apnea
   (C) May cause respiratory depression in neonates **
   (D) It is inherently unpredictable

7. Which of the following is a disadvantage of nitrous oxide for labor analgesia?
   (A) It is necessary for a health care worker to administer it
   (B) Patients must be continuously monitored during use
   (C) Quality of pain control is inferior to that of neuraxial techniques **
   (D) Associated with decreased Apgar scores in newborns

8. In a study by Siddik-Sayyid et al (2014), which of the following was observed in the group of patients receiving phenylephrine by variable-rate infusion with rescue boluses compared to the group receiving boluses alone?
   (A) More hypotension
   (B) More nausea
   (C) More vomiting
   (D) No difference in fetal outcomes

9. In 2014 studies by Desai et al and Bateman et al, which of the following regions of the United States showed the highest number of opioid prescriptions for pregnant women?
   (A) Northeast
   (B) Southeast **
   (C) Midwest
   (D) West Coast

10. Which of the following is the most common reason for opioids to be prescribed during pregnancy?
    (A) Migraines
    (B) Joint pain
    (C) Abdominal pain
    (D) Back pain

Answers to Audio Digest Anesthesiology Volume 58, Issue 37: 1-B, 2-B, 3-A, 4-A, 5-A, 6-C, 7-C, 8-A, 9-B, 10-B