Gerard W. Ostheimer Lecture Syllabus

What’s New in Obstetric Anesthesia – 2014

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Objectives: This syllabus reviews papers published from January 2014 through December 2014 which are significant in their scientific and clinical contribution to the field of obstetric anesthesiology.

Methods: Over 75 journals, websites and newsletters published from January 2014 through December 2014 were searched. These journals were chosen based upon prior Ostheimer journal lists as well as their scientific and clinical relevance to the fields of obstetric anesthesiology, obstetrics, and perinatology. Articles were selected for this syllabus based upon the authors’ opinion regarding their current or eventual potential to influence the field of obstetric anesthesiology.

List of Journals:

Anesthesia

Obstetrics & Gynecology Journals

Perinatology and Pediatric Journals

General Medical Journals

Health Services Research Journals
Health Affairs, Quality and Safety in Health Care

Developmental Neurobiology Journals
Developmental Neurobiology, Neural Development, I Journal of Developmental Neuroscience
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Syllabus

What’s New in Obstetric Anesthesia?

This article reviews the recent literature related to obstetric anesthesia practice including research and practice guidelines. Dr. Hawkins encourages obstetric anesthesiologists to work hard to stay up-to-date with the latest research and guidelines and to be willing to change practice when indicated.

Labor analgesia

4. Carvalho B, Hilton G, Wen L, Weiniger CF: Prospective longitudinal cohort questionnaire assessment of labouring women’s preference both pre- and post-delivery for either reduced pain intensity for a longer duration or greater pain intensity for a shorter duration. British journal of anaesthesia 2014; 113: 468-73

This prospective cohort study surveyed 40 women scheduled for induction of labor both before and after labor (37 women completed both surveys). The surveys asked binary questions such as, “Which scenarios would you prefer? Pain intensity of 2 for 9 hours, or pain intensity of 6 for 3 hours?” Women rated that they preferred lower pain intensity for a longer duration than higher intensity for a shorter duration. This was true for both before (p<0.0001) and after (p<0.0001) their labor experience.


This prospective observational study administered 39 women undergoing induction of labor four validated psychological tests as well as three tests rating anxiety, confidence and analgesic expectations. These psychological outcomes were then related to the analgesic outcomes of time to analgesic request, pain at request for epidural analgesia, area under the pain x time curve, epidural local anesthetic use per hour and maternal satisfaction with analgesia. The authors attempted to statistically achieve a linear relationship between a predictor (the tool used) and the response (the analgesic outcomes). Many of the tests were significantly correlated with at least one analgesic outcome by p values unadjusted for multiple testing, but none remained significant after adjusting for multiple testing. A multivariate linear regression analysis found many of the tests to contribute to a predictive model. Interestingly, an Anxiety Sensitivity Index (ASI) modeled well to the analgesic outcome of labor pain x time, area under the curve. From the Eysenck personality traits, lying contributed to the modeling of time to request labor analgesia. Also, extroversion and psychoticism modeled to labor pain x time area under the curve. Pain catastrophizing related to epidural local anesthetic use; the Fear of Pain (FPQ III) related to a lower maternal satisfaction with labor score.


This observational study assessed 81 women during third trimester with the Adult Attachment Scale - Revised. Attachment style is thought to be determined in infancy via one’s relationships with primary caregivers, remain unchanged throughout life, and describes how an individual relates to others, especially under stress. It is measured in two dimensions: Anxiety (the extent to which one worries about being unloved and abandoned) and avoidance (the extent to which one avoids the closeness of others). In labor, women with secure attachment styles (low anxiety and low avoidance) reported significantly less labor pain (p < 0.001) and consumed significantly lower amounts of analgesics via their PCEA (p < 0.001) than women with insecure attachment styles (high anxiety and/or high avoidance) even though baseline obstetric and demographic data were similar in both groups.

This prospective study asked 300 pregnant women between the gestations of 4 and 36 weeks if they preferred delivery via elective cesarean delivery or vaginal delivery. These women were administered a series of questionnaires including the Childbirth Attitude Questionnaire, Fear of Pain Questionnaire, Depression-anxiety-stress Scale, Pain Catastrophizing Scale, and the Catastrophic Cognition Questionnaire. Fear of childbirth and fear of pain each were independent predictors of women preferring an elective cesarean delivery. Interestingly, catastrophizing fully mediated the relationship between fear of pain and desire for cesarean, but not the relationship between fear of childbirth and desire for cesarean. This study poses the possibility of obstetric anesthesia analgesic services influencing elective cesarean choice for women who have a tendency to catastrophize and/or fear the pain of childbirth.

Epidural labor analgesia

Accompanied by the editorial:
Wisner KL, Stika CS, Clark CT: Double duty: does epidural labor analgesia reduce both pain and postpartum depression? Anesthesia and analgesia 2014; 119: 219-21

This prospective cohort study followed 214 women in a Chinese hospital, 107 of whom requested and received epidural analgesia, and assessed them for postpartum depression at 3 days and 6 weeks. The authors found that women who requested and received epidural analgesia for labor had a lower risk of postpartum depression at 6 weeks as assessed by the Edinburgh Postnatal Depression Scale (OR 0.31, 95% CI 0.12-0.82). The article is accompanied by an editorial which discusses the links between epidural analgesia, diminished postpartum persistent pain and the risk for depression. It also discusses the possibility that the baseline psychological characteristics of women who chose epidural may be different from those who did not in the study. The editorial also acknowledges the difficulty in studying the association in a future randomized controlled trial.


This Cochrane Systematic Review updated in 2014 evaluated the effectiveness and safety of early versus late initiation of epidural labor analgesia. Nine randomized, controlled studies were included (n=15,752) which showed no difference in risk of cesarean delivery (RR 1.02, 95% CI 0.96-1.08), no difference in risk of instrumented vaginal birth (RR 0.93, 95% CI 0.86-1.01), no clinically meaningful difference in length of second stage (Mean Difference -3.22 minutes, 95% CI -6.71-0.27), no difference in APGAR scores less than 7 at 1 minute (RR 0.96, 95% CI 0.84-1.10), umbilical arterial pH (Mean Difference 0.01; 95% CI 0.01 – 0.03), or umbilical venous pH (Mean Difference 0.01; 95% CI 0.00-0.02).


This randomized controlled trial of 112 laboring women evaluated whether epidural neostigmine combined with clonidine decreased breakthrough pain, decreased hourly ropivacaine use, and improved patient satisfaction after a CSE technique. All participants received a CSE with an intrathecal dose of 2.5mL of a solution containing 0.175% ropivacaine and 0.75 mcg/mL sufentanil. The study group then received an epidural bolus of 10ml of a saline solution containing 75mcg clonidine and 500mcg neostigmine. The control group received 10mL of epidural saline. The clonidine/neostigmine group used 32.6% less epidural ropivacaine by PCEA than the placebo group throughout labor (11.6 ± 4.2 versus 17.2 ± 5.3 mg/hour, p < 0.05). Also, only 3% of the clonidine/neostigmine group had breakthrough pain, compared to 36% of the placebo group (p < 0.05). Patient satisfaction after one hour of epidural analgesia was superior in the clonidine/neostigmine group (p < 0.05) but not after 24 hours. The authors conclude that the administration of epidural clonidine and neostigmine as an adjuvant after CSE, improves the quality of epidural labor analgesia.

Labor epidural and second stage of labor

Followed by letters to the editor:
San Roman G: Comment on Second stage of labor and epidural use: a larger effect than previously suggested. Obstetrics and gynecology 2014; 123: 1358-59


Hochner-Celniker D, Solnica A, Lavy Y: Comment on Second stage of labor and epidural use: a larger effect than previously suggested. Obstetrics and gynecology 2014; 123: 1359-60


This retrospective cohort study compared the length of second stage labor (median lengths and 95th percentiles) in women with and without epidurals. The dataset involved 42,268 women stratified by parity who were undergoing vaginal delivery at University of California, San Francisco between 1976 and 2008. The authors found that for nulliparous women who labored without an epidural, the 95th percentile length of second stage was 197 minutes while the length of second stage for women with an epidural was 336 minutes (p<0.001), which was a difference of over 2 hours. Likewise, for multiparous women, the 95th percentile was 81 minutes for those without an epidural and 255 minutes for those with an epidural (p<0.001), a difference of nearly 3 hours. The authors question whether obstetricians should lengthen the current “recommendations for intervention during the second stage of labor (which) have been based on a 1-hour difference in the setting of epidural use.” Although the authors don’t claim that their study demonstrates causation, this study has been viewed by some to be controversial. Because of its retrospective design, it has the biases of retrospective labor analgesia studies such as cross-over, drop-out, lack of blinding of providers and patients, etc. The epidural labor analgesia techniques utilized at the institution between 1976 and 2008 are not described. The length of time over which data was collected could further bias the study—for example, as the prevalence of epidural analgesia increased, the practice of forceps and vacuum-assisted deliveries could have decreased in longer second stages over time.


This population-based retrospective cohort study using data from the Perinatal Registry of the Netherlands between 2000 and 2009 found that among nulliparous women (n=616,063) epidural labor analgesia use tripled over the time period from 7.7% to 21.9%, while rates of cesarean delivery increased only by 2.8% and instrumented vaginal delivery decreased by 3.3%. In multiparous women (n=762,395), epidural analgesia use increased from 2.4% to 6.8% while rates of cesarean delivery increased only by 0.8% and instrumented vaginal delivery decreased by 0.7%. Although, in multivariate analysis, there was a positive association between epidural analgesia and cesarean delivery, this weakened over time for both nulliparous (Year 2000-- OR 2.35 [95% CI. 2.18 – 2.54] VERSUS Year 2009-- OR of 1.69 [95% CI 1.60-1.79], p<0.001) and multiparous women (Year 2000-- OR 3.17 [95% CI, 2.79 – 3.61] VERSUS Year 2009-- OR 2.56 [95% CI 2.34-2.81], p<0.001). From these results, the authors conclude that because there was a triplication of epidural labor analgesia in the Netherlands with relatively stable rates of operative deliveries, “epidural analgesia is not an important causal factor of operative deliveries.”


This retrospective cohort study evaluated 61,308 vaginal deliveries that occurred at an Israeli hospital between 2006 and 2011 and studied the association between epidural labor analgesia and the risk of severe perineal tears. Within the cohort, 31,631 (51.6%) of women received epidural analgesia. Epidural labor analgesia was associated with higher rates of primiparity, induction and augmentation of labor, prolonged second stage, instrumented vaginal birth and episiotomy. Therefore, it is not surprising that univariate analysis showed an association between the use of epidural analgesia and severe perineal tears (OR 1.78, 95% CI 1.34 to 2.36). However, in multivariate analysis, the association disappeared (OR 0.95, 95% CI 0.69 to -1.29). The authors conclude that this suggests that the “factors that lead to a woman’s request for epidural analgesia, such as poor labor and primiparity, may be similar to those that lead to severe perineal tears.”


This population-based retrospective cohort study using the Danish Medical Birth Registry looked for the incidence of obstetric anal sphincter injury in 214,256 primiparous women undergoing vaginal delivery between 2000 and 2010. Although epidural analgesia was a risk factor in univariate analysis, (OR 1.12, 95% CI 1.01-1.17, p< 0.0001) when adjusting for birthweight and vacuum extraction, epidural
analgesia became a protective factor for sphincter injury (OR 0.94 [95% CI 0.9 - 0.98] p=0.0028). In multivariable analysis that also included multiple fetal and obstetric factors (besides BMI), epidural became even more protective (OR 0.84 [95% CI 0.81-0.88] p=0.0001). In this study, confounding factors masked the potential benefits of epidural analgesia to the perineum.


This retrospective cohort study evaluated electronic medical records of 43,810 nulliparous and 59,602 multiparous women from 19 U.S. hospitals who delivered 36 week or greater, singleton, vertex babies between 2002 and 2008. They defined prolonged second stage in nulliparous women with an epidural as greater than 3 hours, and without an epidural as greater than 2 hours. They defined prolonged second stage in multiparous women with an epidural as greater than 2 hours and without an epidural as greater than 1 hour. Prolonged second stage occurred in 9.9% of nulliparous women with an epidural; 13.9% of nulliparous women without an epidural; 3.1% of multiparous women with an epidural and 5.9% of multiparous women without an epidural. Prolonged second stage was associated with increased rates of chorioamnionitis, third and fourth degree lacerations, neonatal sepsis, neonatal asphyxia, and perinatal mortality. Among all babies born to women with epidurals who had a prolonged second stage (3,533 nulliparous and 1,348 multiparous women), there were no cases of hypoxic-ischemic encephalopathy or perinatal death.

Epidural Fever


Accompanied by letter to the editor:

This double-blinded trial randomized 400 healthy primiparous women to either receive 2 grams of intravenous cefoxitin or placebo immediately prior to epidural labor placement with intrapartum fever as its primary outcome. Antibiotics did not reduce fever rates: 38% (75/200) and 40% (79/200) of women in the cefoxitin group and placebo group respectively developing fever defined as a tympanic membrane temperature of 38.0 C or greater (p=0.68). The antibiotics did not reduce neutrophilic inflammation of the placental membranes: 49% (74/150) of the cefoxitin group and 55% (84/152) of the placebo group (p=0.30). Notably placental inflammation and fever were linked with 69% (73/106) of women who developed fever had placental neutrophilic inflammation, compared to 43% (85/196) of women who remained afebrile (p < 0.001). The relationship remained significant in reverse with 73/157 women who had placental inflammation developed fever while in women with no inflammation only 33/144 developed fever (p < 0.001). These authors concluded what other studies on epidural fever have supported—that infection is not likely to be the cause of epidural fever development and that epidural fever is associated with placental inflammation. This article is accompanied by an editorial by Laura Goetzl. She summarized the study by saying, “prophylactic antibiotic treatment does not alter the subsequent rate of fever... (which) provides very strong evidence against an infectious etiology for epidural fever in obstetric patients.” She goes on to state that the association of fever and neutrophilic placental inflammation (which was not reduced by antibiotics) supports previous research which “demonstrated an association between intrapartum fever and noninfectious histologic placental chorioamnionitis.” She encourages future researchers to focus new research efforts on “interventions that block the maternal inflammatory response to epidural analgesia without increasing maternal or fetal risks.”

Combined Spinal Epidural


This randomized study gave 300 nulliparous women in first stage of labor 1 of 30 different combinations of intrathecal fentanyl and bupivacaine via a CSE technique. Pain scores via visual analogue scale were recorded with response defined as percentage decrease in pain score from baseline at 15 and 30 minutes. Hyperbolic dose-response models were calculated using nonlinear regression, and drug interaction was evaluated by comparing observed effects to effects that would be predicted by additivity. Combinations of fentanyl and bupivacaine produced greater effects than that predicted by additivity at 15 minutes (p < 0.001) and 30 minutes (p=0.015) indicating a synergistic interaction between the two drugs when dosed intrathecally in labor.

This meta-analysis included 10 randomized controlled trials (n = 1722 women) that compared the success of an epidural catheter after a CSE versus an epidural technique. They found that the risk of a unilateral block was decreased with a CSE technique (RR 0.48, 95% CI 0.24-0.97) although heterogeneity was present between studies (I^2 = 69%, p = 0.01). Unlike previous observational studies have suggested, this meta-analysis found no difference in rates of epidural replacement or epidural top-up. Therefore, this meta-analysis does not support the thought that epidural catheters placed by a CSE technique are more reliable.


Accompanied by editorial:
Hawkins JL. Can we keep our mothers happy and our babies safe? Canadian journal of anaesthesia 2014; 61: 691-4

This meta-analysis included 21 trials with 2,859 laboring women who were randomized to epidural/spinal local anesthetics with opioids versus epidural/spinal local anesthetics without opioids. The various studies each contained different doses and concentrations of opioids in both intrathecal doses and epidural solutions/rates, and multiple studies did not calculate doses of opioids for either the entirety of labor or in amounts per hour. Between the groups, however, there were no differences in the incidence of APGAR scores < 7 at one minute (Risk difference 0.0%, 95% CI -1.0 - 2.0; p = 0.78; I^2 = 0%, 95% CI 0 - 50), or at 5 minutes (Risk difference -1.0%, 95% CI -2.0 - 1.0, p = 0.31; I^2 = 0%, 95% CI 0 - 50), and no significant differences in the Neurologic and Adaptive Capacity Scores at 2 hours (Mean difference -0.35, 95% CI -1.70 - 1.01, p = 0.62; I^2 = 0%, 95% CI 0 - 79), or at 24 hours (Mean difference -0.45, 95% CI -1.36 to 0.46, p = 0.33; I^2 = 3%, 95% CI 0 - 26), and no difference in umbilical artery pH (Mean difference -0.02, 95% CI -0.6 - 0.03, p = 0.48, I^2 80%, 95% CI 46 - 92) or umbilical vein pH (Mean difference -0.03, 95% CI 0.07 - 1.00, p = 0.08; I^2 = 77%, 95% CI 36 - 91). The authors conclude that fentanyl and sufentanil in common neuraxial doses are safe for neonates during the first 24 hours of life.


Followed by letter to the editor:
Swini KA, Jain K, Makkar JK, Bagga R. Intrathecal opioids and fetal heart rate abnormalities. Anaesthesia 2014; 69: 458-67

This trial assessed for fetal heart rate changes in women randomized to initiation of labor analgesia with either a combined spinal epidural with intrathecal administration of 2.5mg bupivacaine and 5mcg fentanyl (n = 62) or an epidural without dural puncture loaded with a 20mL epidural bolus of 0.1% bupivacaine with 2mcg/ml fentanyl (n = 53). Fetal heart rate tracings were analyzed for the 30 minutes before and 60 minutes after initiation of labor analgesia and were categorized as normal, suspicious, or pathological. There were no significant differences between groups in the incidence of abnormal fetal heart rate patterns before or after analgesia. In both the CSE and the epidural groups, there was a significant increase in the incidence of abnormal fetal heart rate patterns following the initiation of analgesia (p<0.0001). In the CSE group there were 2 patients who had abnormal fetal heart rate patterns before analgesia and 8 after, and in the epidural group there were 0 before and 11 after. Apgar scores and arterial and venous cord gasses were not different between groups. The authors conclude that initiation of labor analgesia with CSE instead of epidural during the first stage of labor does not increase the risk of FHR abnormalities.

Neuraxial technique


This Cochrane Systematic Review updated in 2014 evaluated the safety and efficacy of air and saline in the loss of resistance technique. Seven studies involving 852 participants found no significant differences between those that utilized air versus saline in the inability to located the epidural space (RR 0.88, 95% CI 0.33-2.31), intravascular catheter placement (RR 0.90. 95% CI 0.33-2.45), intrathecal catheter placement (RR 2.95, 95% CI 0.12 -71.90), CSE failure (RR 0.98, 95% CI 0.44 - 2.18) unblocked segments (RR 1.66, 95% CI 0.72 – 3.85), pain measured by VAS (Mean difference -0.09, 95% CI -0.37 – 0.18), paresthesias with catheter placement (RR 0.89, 95% CI 0.69 – 1.15), difficulty advancing the catheter (RR 0.91, 95% CI 0.32 – 2.56), and catheter replacement (RR 0.69, 95% CI 0.26 – 1.83). All evidence was considered to be of low quality.

This prospective observational study surveyed anesthesiologists who had epidural catheter advancement difficulty among 2148 epidural catheter placements. The authors found that the inability to advance the Arrow FlexTip Plus occurred in 97 cases (4.7%, 95% CI 3.7 – 5.5%). The incidence of accidental dural puncture was 3.1% if an inability to advance occurred, compared to 1.2% for other placements (p = 0.12). Nine different corrective maneuvers were performed by the anesthesiologists with injection of saline through the epidural needle beneficial. Removing the needle and performing a new placement was the most successful maneuver.

Asepsis


This guideline for asepsis for neuraxial blocks was published by the Association of Anaesthetists of Great Britain and Ireland, the Obstetric Anaesthetists’ Association, Regional Anaesthesia UK, and the Association of Paediatric Anaesthetists of Great Britain and Ireland. This statement is similar in some ways to those published by The Royal College of Anaesthetists, the ASA, and ASRA. However, in contrast, in this guideline the use of a sterile gown by the proceduralist is recommended. They do recommend skin asepsis with chlorhexidine in alcohol; however, they specifically recommend the use of a 0.5% chlorhexidine solution over a 2% solution because of the neurotoxicity of chlorhexidine. They give multiple recommendations regarding keeping chlorhexidine from getting accidentally injected into the neuraxis in a drug error, and state that chlorhexidine should be allowed to dry prior to palpating or puncturing the skin. They state that if chlorhexidine gets on the gloves of the proceduralist, the gloves should be changed and recommend chlorhexidine being minimized in its dose on the skin for patients less than 2 months old.


This study randomized 240 obstetric patients (214 completed the study) to getting an epidural placed with their anesthesiologists either steriley gowned or not gowned at all. In the un-gowned group 10 patients (9.2%) grew positive cultures from their epidural catheter tip upon removal versus 8 patients (7.6%) in the gowned group (p = 0.807). Although this study showed that there were increased colonization of the forearms of exposed skin versus the gowned forearm (mostly coagulase negative staph and bacillus species), there was no clear advantage in gowning for epidural procedures.


This simulation study trained 21 trainees the aseptic technique for epidural placement via a lecture and a video demonstration after which the residents scored an average of 6.0 on a 15 point checklist when performing an epidural placement. The residents were then given a one-on-one hands-on demonstration using a Styrofoam model and their score increased to 10.8 (difference = 4.8, 95% CI 3.3 to 6.2, p < 0.001). Likewise, the fellows went from a score of 7.9 to 11.2 (difference = 3.3, 95% CI 0.05-6.6, p= 0.047) with the hand-on simulation. The authors encourage a low-fidelity simulation modality to improve learning when teaching sterile technique for epidural placements.

Anticoagulation


This retrospective review evaluated the anticoagulant prescribing patterns and the anesthetic interventions among women who delivered at the Lucile Packard Children's Hospital, Stanford University between 2003 and 2009. The authors identified 101 patients on anticoagulation of which 90.1% (91 patients) received enoxaparin. Of these, 42.8% (39 patients) received enoxaparin only, and 45.1% (41 patients) received enoxaparin and were converted to subcutaneous unfractionated heparin, while 12.1% (11 patients) received enoxaparin and were converted to intravenous unfractionated heparin. There was wide variation in the prescribing patterns of enoxaparin and unfractionated heparin even among patients with similar indications for anticoagulation. Amongst all of these anticoagulated patients, 80.2% received a neuraxial anesthetic. The time period between enoxaparin dose and neuraxial placement
was significantly shorter in patients transitioned from enoxaparin to unfractionated heparin than those who remain on enoxaparin (54 hrs [12–192 hrs] (n = 26) vs 216 hrs [39 – 504 hrs] (n=230), p = 0.04). The authors discuss the ACOG Practice Bulletin for VTE prophylaxis and thrombophilia and the ASRA recommendations which both recommend bridging patients from enoxaparin to unfractionated heparin during the last month of pregnancy which happened in 45.1% of patients in this study.


Between 2000 and 2012, 292 women with a history of thrombophilia were randomly allocated in a 1:1 ratio to either antepartum prophylactic dose dalteparin (5000 international units once daily up to 20 weeks' gestation, and twice daily thereafter until at least 37 weeks' gestation) or to no antepartum dalteparin (control group). Dalteparin did not reduce the incidence of the primary composite outcome which was severe or early onset pre-eclampsia, small-for-gestational-age infant, pregnancy loss, or venous thromboembolism (dalteparin 25/146 [17.1%; 95% CI 11.4–24.2%] versus no dalteparin 27/143 [18.9%; 95% CI 12.8–26.3%]; risk difference –1.8% [95% CI –10.6% to 7.1%]). Minor bleeding was more common in the dalteparin group (28/143 [19.6%]) than in the no dalteparin group (13/141 [9.2%]; risk difference 10.4%, 95% CI 2.3–18.4; p=0.01). Because of this study, obstetric anesthesiologists may be less likely to see patients presenting in labor with dalteparin prophylaxis, after which the ASRA guidelines recommend waiting 12 to 24 hours (depending on the dose) prior to neuraxial techniques.

Ultrasound guidance for neuraxial placement


This controlled trial randomized 150 healthy women with a BMI ≤ 35kg/m² undergoing cesarean delivery to either ultrasound-guided spinal needle placement or a traditional landmark technique. The proceduralists were experienced in both landmark and ultrasound technique. The authors found that the average procedure time (Landmark 52.5 ± 55.8sec versus Ultrasound 41.4 ± 44.7sec, p = 0.18), the number of skin punctures (Landmark 1.31 ± 0.7 versus Ultrasound 1.12 ± 0.4, p = 0.07), the number of needle passes (Landmark 1.99 ± 1.5 versus Ultrasound 1.67 ± 1.2, p = 0.20), and the success of spinal anesthesia after one needle pass (Landmark 62% versus Ultrasound 65%, p = 0.175) were not different between groups.


These authors report the development of an ultrasound probe through the center of which an epidural needle passes. This probe can identify the difference between lumbar interspaces versus bone using A-mode ultrasound. After testing in a plastic model and a porcine model, the authors found that in epidural placements in humans, the echo variation between the interspace and L3 was 48%, and the maximum bone echo was at least three times stronger than the interspace echo. They concluded that their new device could offer a method for reducing bone contact during epidural placement.

Systemic opioid labor analgesia


This prospective randomized controlled trial compared the analgesic efficacy of 150mg intramuscular meperidine (n=240) to 7.5mg intramuscular diamorphine (medical heroin) (n=244) for women in labor. After two hours, women were able to get a second dose of their study medication, but no more than 2 doses total were allowed. There was no difference in the neonatal primary outcome which was the need for resuscitation or APGAR score <7 at one minute. Diamorphine provided better pain relief at 60 minutes (mean difference on VAS 1cm, 95% CI 0.5–1.5). Interestingly, the average length of labor (measured as first dose of analgesia to delivery) was, on average, 82 min (95% CI 39–124min) longer in the diamorphine group than the meperidine group in spite of all obstetric baseline characteristics being similar. Because labor was longer in the diamorphine group, in an area-under-the-curve assessment, women experienced labor pain over a longer period of time in the diamorphine group and therefore had “greater total pain.” The authors conclude that “this study does not support the use of diamorphine versus meperidine for labor pain.” The significant difference in length of labor between drugs is curious and begs the question whether there is a systemic opioid that speeds the labor process.
Remifentanil
This systematic review and meta-analysis was designed to compare analgesia amongst parturients receiving either remifentanil intravenous patient-controlled analgesia (IV-PCA) or epidural analgesia. Five RCTs (n= 886 healthy parturients with 443 receiving remifentanil IV-PCA) were analyzed. Validity assessment reported overall quality as moderate amongst the included trials. Epidural anesthesia was shown to provide superior analgesia with parturients reporting lower VAS pain scores at both 1 hour (5 RCTs) and 2 hours (3 RCTs) after administration than scores reported by women receiving remifentanil IV-PCA. There were no significant differences in secondary outcomes of nausea, pain, and pruritus and no statistically significant differences in umbilical artery pH values in the included trials. No trials reported significant differences in Apgar scores or neonatal outcomes between remifentanil and epidural analgesia. Wide confidence intervals with potentially clinically-significant differences were shown for pruritus, nausea, and vomiting between the remifentanil and epidural groups suggesting that further study is necessary before more definitive conclusions are drawn on these secondary outcomes.

This concise article reviews the efficacy, dose, and safety of remifentanil in obstetric anesthesia. The authors state that “although neuraxial blockade is the "gold standard" for labor analgesia, systemic analgesia is useful in those cases in which neuraxial analgesia is contraindicated, refused or simply not needed by the parturient, or when skilled anesthesia providers are not available.”

This systematic review compared included 7 studies with 349 patients that compared remifentanil and meperidine intravenous analgesia in reducing pain scores in laboring women. Only 3 studies including a total of 233 women met the authors’ criteria to be included. In the meta-analysis, remifentanil reduced the mean VAS score at 1 hour by 25mm (95% CI 19-31mm) more than meperidine (P < 0.001).

Accompanied by editorial:
Birnbach DJ, Ranasinghe JS: Is remifentanil a safe and effective alternative to neuraxial labor analgesia? It all depends. Anesthesia and Analgesia 2014; 118:491-493
This unblinded, randomized controlled non-inferiority trial at a single center compared remifentanil intravenous patient controlled analgesia (IV-PCA, 20mcg to maximum bolus dose of 60 mcg every 1-2 minutes) to epidural analgesia (1% bupivacaine with 2mcg/ml fentanyl) among 40 healthy women in active labor with term, cephalic singleton pregnancies. The methodology in this study was critiqued in the accompanying editorial for allowing for crossover of interventions after 30 minutes (4 crossed over; 3 from remifentanil group, 1 from epidural group), as well as the fact that this study did not control the dose or regimen of remifentanil IV-PCA administration. Results of this study indicated that remifentanil IV-PCA is effective, albeit inferior to, epidural analgesia as measured by NRS pain scores (pain score at 30 minutes was 3.7 +/-2.8 for remifentanil and 1.5 +/-2.2 for epidural analgesia, p=0.009) with data robust at all measured time points (notably worse analgesia provided by remifentanil as labor progressed). Maternal satisfaction, the other primary outcome, was not significantly different between groups. Notably, statistically significant more episodes of respiratory depression (SpO2 monitoring) despite continuous oxygen supplementation and maternal apnea (end-tidal CO2 monitoring) were recorded in the remifentanil IV-PCA group (total 9 apnea events; all occurred in 5/19 women receiving remifentanil). Apgar and neonatal respiratory outcomes were similar between the groups. Capnography data showed maternal apnea without episodes of oxygen desaturation suggesting the importance of combining capnography with pulse oximetry monitoring for high-risk OB populations in the peripartum period receiving remifentanil.

This retrospective cohort study compared analgesia with remifentanil intravenous patient controlled analgesia (IV-PCA) to epidural analgesia among primiparous parturients at term. Medical records of 370 parturients were reviewed for pain and sedation scores, overall satisfaction, maternal side-effects and neonatal outcomes. Analgesia was greater in the epidural group throughout the study period compared with remifentanil IV-PCA; and women receiving epidural analgesia rated satisfaction higher than those receiving IV opioid therapy. Also, those parturients who received remifentanil IV-PCA had worsening pain relief scores as labor progressed to the later stages. Additionally, parturients receiving remifentanil IV-PCA had lower oxygen saturations (despite continuous oxygen supplementation) and more sedation than patients receiving epidural analgesia.

**Alternative labor analgesia**

**Water immersion**


This Committee Opinion from the American College of Obstetricians and Gynecologists as well as the American Academy of Pediatrics states that although immersion in water during the first stage of labor may be associated with decreased pain or use of anesthetics, immersion in water during the second stage has not been associated with maternal or fetal benefit, and has been associated with case reports of rare but serious adverse newborn effects. The committee, therefore, states that “the practice of immersion in the second stage of labor (underwater delivery) should be considered an experimental procedure that only should be performed in the context of an appropriately designed clinical trial with informed consent.” The committee then goes on to state that facilities that offer immersion in water during the first stage of labor should have rigorous protocols and procedures in place to prevent infection and injury and provide appropriate monitoring.

**Nitrous oxide**


Accompanied by editorial:

King TL, Wong CA: Nitrous oxide for labor pain: is it a laughing matter? Anesthesia and analgesia 2014; 118:12-4

This systematic review identified 58 publications about the effectiveness, patient satisfaction and adverse effects of nitrous oxide for labor pain management. These authors published the 2011 comparative effectiveness review for the U.S. Agency for Health Care Research and Quality (AHRQ). This systematic review reports that only 2 studies were of good quality, 11 fair and 46 poor. The outcomes were heterogeneous. Nitrous oxide was less effective than epidural labor analgesia. Reported adverse effects included nausea, vomiting, dizziness and drowsiness. Apgar scores were no different between mothers who used nitrous oxide and those who used other or no pharmacologic labor analgesia. This review is accompanied by an editorial that emphasizes the “paucity of good data” regarding nitrous oxide for labor analgesia and states that the results of the systematic review are “frustratingly inconclusive.” These authors discuss previous reviews published on the topic and point out that nitrous oxide use is decreasing outside of obstetric units because of concerns about “neurologic and hematologic toxicity, adverse immunologic effects, genotoxicity, risk of myocardial ischemia, expansion of air-filled body cavities, and increased risk for postoperative nausea and vomiting.” Because of concerns with chronic occupational exposure to healthcare workers, and nitrous oxide’s potential effects on DNA synthesis and neuroapoptosis, the authors state that “if we want to use nitrous oxide in the childbirth environment, additional rigorous study is necessary.

**Cesarean Delivery**

**Decision to delivery time for emergent cesarean delivery**


Followed by letter to the editor:


This retrospective observational study examined maternal and neonatal outcomes after implementation of an initiative to shorten the interval from decision-to-incision (DDI) for emergent cesarean delivery performed for nonreassuring fetal heart rate at a single, academic center in Israel. 593 deliveries were evaluated over 54 months. The programs focused not only on achieving the 30-minute
ACOG/RCOG time standard, but also, to shorten DDI as much as possible through continuous protocol evaluation. General anesthesia was preferred in all cases unless regional anesthesia was already in place. Results indicate a statistically significant decrease in mean DDI (12.3 +/- 3.8 min epoch 2 compared to 21.7 +/- 9.1 min epoch 1) following this program audit. Notably, general anesthesia occurred significantly more often and was found to be an independent predictor (by stepwise analysis) of shorter DDI in the second epoch. This study did not report on airway management including failed intubation and was not adequately powered to examine low-incidence complications such as aspiration. Composite neonatal outcomes were improved in epoch 2 with no change in composite maternal complications following introduction of this management protocol.


This systematic review and meta-analysis identified 34 studies (22,936 women) reporting decision-to-incision time or delivery time intervals for nonelective (both emergent and urgent deliveries). Differences in neonatal outcomes accomplished within 30 minutes and beyond 30 minutes were also compared. Anesthesia-related outcomes (e.g., general or regional anesthesia type) were not assessed. Only 5 of 34 studies were considered to be high quality with most papers failing to control for the level of urgency or indication for delivery. Overall, delivery within 30 minutes was not achieved in a substantial proportion of cases [79% of category I (emergent) deliveries; 36% of category 2 (urgent) deliveries were achieved within the 30-minute standard). Neonatal outcomes (5-minute Apgar scores and umbilical pH levels) were overall worse when delivery occurred within 30 minutes; however, the authors stressed the importance of confounding as in these most emergent situations, it was more likely for infants to be delivered under non-reversible situations (e.g. cord prolapse) and would therefore have poorer short-term neonatal outcomes. Analyses limited to category 1 deliveries did not differ by delivery interval.

Anesthesia for cesarean delivery


This study drew venous blood and measured progesterone levels from 90 women > 36 weeks gestation undergoing elective cesarean delivery under general anesthesia induced with thiopental and rocuronium and maintained with sevoflurane and nitrous oxide titrated to blood pressure, heart rate and a BIS value. A patient controlled analgesic device was given to all patients that contained a solution of morphine, ketorolac and ondansetron. Interestingly, there was a negative correlation between sevoflurane consumption and serum progesterone levels (Pearson correlation r = -0.26; 95% CI -0.44 to -0.05, p=0.01), and an inverse correlation between analgesic consumption at 2 (r=0.20, p=0.05), 24 (r=-0.25, p=0.02), and 48 (r = -0.28, p=0.01) hour and progesterone levels. Women with progesterone levels greater than the median value had lower sevoflurane consumption per hour (p=0.02) and lower 48-hour postoperative cumulative analgesic consumption (p=0.02). The authors conclude that the “decreased anesthetic and analgesic requirements of near full-term parturients might partially depend on serum progesterone concentration.”


This trial randomized women to one of three positions after the intrathecal placement of fentanyl, morphine and 1.5mL of 0.75% hyperbaric bupivacaine: 1- a head elevated ramped position (pillow under the torso); 2- A control position with the patient lying flat with a small pillow under the head; and 3- Initially placing the patient in the control position and then moving the patient to the head-elevated ramped position. The authors found that there was no difference in their primary outcome which was the time to a T4 block height among the groups (p=0.14), however, there was a significantly lesser number of patients who reached a block height of T4 at 12 minutes, and a greater need for epidural supplementation in the head-elevated ramped position group (p=0.21). The authors conclude that “cautious use of this novel position can provide a more comfortable experience and provide a better airway position” for patients.

The obstetric airway

This study compared 18 females aged 15 to 55 years to 22 male CT scans of the neck and found that in both populations, the cricothyroid membrane was not necessarily a superficial structure that could be easily palpated. The vertical height (9.9 [7-17]mm versus 11.4[8-15]mm, p = 0.04) and maximum width (12.5 [10-15]mm vs 14.5 [10-17]mm, p<0.01) of the cricothyroid membrane was greater in males. The authors conclude that because the external diameter of commercial trochar devices and tracheal tubes may exceed 7mm, smaller than recommended cricothyrotomy devices may be required for women of childbearing age.


This prospective observational study followed 36 women through pregnancy and measured their pharyngeal cross sectional area using the upper airway acoustic reflective method. The authors found that the mean pharyngeal cross-sectional area decreased (p<0.001) and Mallampati scores increased (p<0.001) between the first and third trimesters of pregnancy. Although there was a mean weight gain throughout pregnancy, there was not a statistically significant change in neck circumference.

44. Marshall SD, Mehra R: The effects of a displayed cognitive aid on non-technical skills in a simulated 'can't intubate, can't oxygenate' crisis. Anaesthesia 2014; 69: 669-77

This simulation study randomized 64 participants into either having or not having a cognitive aid to simulate a ‘can’t intubate, can’t oxygenate’ scenario. All categories had higher Anaesthetists’ Non-Technical Skills (ANTS) scores when a cognitive aid was supplied (10.4 ±3.1 vs 13.2 ±2.4, p<0.001) and the number of times that the cognitive aid was used was associated with higher ANTS scores. There was a trend toward faster establishment of an infraglottic airway in the cognitive aid group as well (55.3% of controls and 76.9% of cognitive aid group established airway under 3 minutes, p=0.076).

Aspiration


This prospective study used ultrasound to determine gastric volume changes in women laboring with epidural analgesia. First, the authors determined a cross sectional area (CSA) cut-off number by giving 6 pregnant non-laboring women 250mL of non-clear liquid and found that the antral CSA went from 90 (80-15)mm² to 409 (317-463)mm². From this data they determined that “increased gastric content” was associated with a CSA of 320mm² in the term pregnant women. Then, the authors measured antral CSA in 60 parturients in labor both at the time of epidural placement and at complete dilation and found that CSA decreased from a median of 319 (158-469)mm² to 203 (123-261)mm² during this time (p=2x10⁻¹⁰). Although antral CSA was >320 mm² in 29/58 (50%) of women at epidural insertion, only 7/52 (13%) had antral CSA measurements >320 mm² at full cervical dilation. The amount of decrease in antral CSA was associated with the time interval between epidural placement and full cervical dilation. This study shows that gastric emptying occurs in women laboring under epidural analgesia.


This prospective study randomized 32 women at greater than 32 weeks gestation to have an ultrasound performed by one of three anesthesiologists either while fasting, after drinking clears only, or after eating solid food. The overall proportion of correct diagnoses was 87.5% (84 of 96 tests). The interrater reliability showed a kappa statistic of 0.74 (bias corrected 95% CI 0.68-0.84) which the authors conclude shows the consistency of gastric ultrasound assessment for gastric contents in third trimester women.

47. Paranjothy S, Griffiths JD, Broughton HK, Gyte GM, Brown HC, Thomas J: Interventions at caesarean section for reducing the risk of aspiration pneumonitis. The Cochrane database of systematic reviews 2014; 2: CD004943

This Cochrane Systematic Review updated in 2014 evaluated interventions at cesarean delivery to reduce the risk of aspiration pneumonitis. Overall, 22 studies involving 2658 women who underwent general anesthesia for cesarean delivery were included. Antacids reduced the risk of intragastric pH < 2.5 compared with no treatment or placebo (2 studies, 108 women; RR 0.17, 95% CI 0.09 – 0.32), as did H₂ antagonists (2 studies, 170 women; RR 0.09, 95% CI 0.05-0.18) and proton pump inhibitors (1 study, 80 women; RR 0.26, 95% CI 0.14 – 0.46). H₂ antagonists were superior to proton pump antagonists at reducing pH to <2.5 at intubation (1 study, 120 women; RR 0.39. 95% CI 0.16 – 0.97). Antacids combined with H₂ antagonists were associated with a significant reduction in the risk of
intragastric pH < 2.5 at intubation in comparison to placebo (1 study, 89 women; RR 0.02, 95% CI 0.00 – 0.15), or in comparison to antacids alone (1 study, 119 women; RR 0.12, 95% CI 0.02 – 0.92).

**Intraoperative awareness**


Jonker WR, Hanumanthiah D, O’Sullivan EP, Cook TM, Pandit JJ: *A national survey (NAP5-Ireland baseline) to estimate an annual incidence of accidental awareness during general anaesthesia in Ireland*. Anaesthesia 2014; 69: 969-76

These papers report the findings of the 5th National Audit Project (NAP5) of the Royal College of Anaesthetists and the Association of Anaesthetists of Great Britain and Ireland. This prospective study involved 269 coordinators in 329 UK hospitals and 41 coordinators in 46 Irish hospitals who provided reports of accidental awareness under general anaesthesia at their hospitals. The NAP5 panel then met monthly, reviewed cases and classified them according to likelihood of true awareness under general anaesthesia. The denominator was obtained during the 4th national audit project and was 2.8million general anesthetics. In the NAP5 the incidence of awareness was about 1 in 19,000 general anesthetics, with the most pessimistic estimate being about 1 in 6000 general anesthetics. Interestingly, the most over-represented surgical speciality was obstetrics with 12 cases of certain, probable or possible accidental awareness out of 8000 cesarean deliveries under general anaesthesia resulting in an incidence of 1:670 (1:380-1300). The authors attribute this high incidence during cesarean delivery to multiple risk factors potentially being present in OB anesthesia that were identified elsewhere in the NAP5 data to contribute to accidental awareness including: rapid sequence induction, omission of opioids at induction, almost always using thiopental and sometimes at inappropriately low doses, difficult airway management, obesity, use of neuromuscular blocking agents, brief period between anesthetic induction and surgical incision, high incidence of emergent surgery, and high rates of off-hours surgery resulting in higher rates of non-consultant care.

49. Zand F, Hadavi SM, Chohedri A, Sabetian P: *Survey on the adequacy of depth of anaesthesia with bispectral index and isolated forearm technique in elective Caesarean section under general anaesthesia with sevoflurane*. British journal of anaesthesia 2014; 112: 871-8

This prospective study evaluated the relationship between the bispectral index (BIS) values and responses to the isolated forearm technique to evaluate depth of anesthesia. The isolated forearm technique involves inflating a forearm blood pressure cuff to 200mmHg during and after induction to isolate the forearm from the effects of neuromuscular blocking agents. Earphones were placed in the patient’s ears and the patient was told to ‘open and close your right hand’ every 30 seconds for 20 minutes during and after induction. Hand movement was recorded. Interestingly, after an induction of 4-5mg/kg thiopental and 1-2mg/kg succinylcholine followed by 50% nitrous and 1.8-2.2% end tidal sevoflurane, 40%, 46% and 23% of parturients had positive isolated forearm test results at laryngoscopy, intubation, and skin incision. BIS could not reliably differentiate the forearm test responders and non-responders during these times. No patients had evidence of recall during a structured interview performed 12-24 hours postoperatively.

**Oxygen administration**


These authors studied nine healthy pregnant women at 21-33 weeks of gestation and five nonpregnant adults. They studied how fetal brain oxygenation changed as maternal oxygen administration was increased with magnetic resonance imaging through the theory that oxygen administration changes the magnetic longitudinal relaxation time T1 in the brain. During MRI, the air supply to mothers was changed from medical air (21% oxygen) to medical oxygen (100% oxygen) and T1 was monitored over time in both the placenta and fetal brain using a periodically repeated magnetic resonance imaging sequence. The nonpregnant adults showed the MRI change in their brain with oxygen administration. However, although a significant placental change was seen with the maternal oxygen
administration, the authors found no significant change in the fetal brains. The authors conclude that short-term maternal oxygen administration does not improve fetal brain oxygenation.


This review article discusses that only two randomized trials have investigated the use of maternal oxygen supplementation in laboring women and they do not support that supplementation is beneficial to the fetus. The authors state that, “by increasing free radical activity, maternal oxygen supplementation may even be harmful. Based on a review of the available literature, we conclude that until it is studied properly in a randomized clinical trial, maternal oxygen supplementation in labor should be reserved for maternal hypoxia, and should not be considered an indicated intervention for nonreassuring fetal status.”

**Spinal anesthesia hypotension**


This trial randomized women (n=50) to the either 11.25mg or 15mg intrathecal hyperbaric bupivacaine for cesarean delivery, and then determined how long the patient remained in the sitting position after intrathecal injection via an up-down sequential allocation design with the goal of preventing a >20% drop from baseline systolic blood pressure pre-delivery. The median effective sitting time for 11.25mg was 130sec (95% CI 117 - 150sec) and for 15mg was 385 sec (95% CI 381 to 396). Interestingly, the onset and maximum cranial spread of the anesthetic block was similar in both groups as well as between those who did and did not experience hypotension. There were seven patients in the 11.25mg group and four patients in the 15.0mg group who required additional analgesia for peritoneal closure.


This prospective, double-blind, placebo-controlled study randomized women (n=128) scheduled for elective cesarean to either 0mg, 2mg, 4mg, or 8mg intravenous ondansetron administered prior to spinal anesthesia induction. Among the groups there were no differences in the number of patients with systolic hypotension (p=0.77), the percentage of time points with hypotension (p=0.32), ephedrine administration (p=0.11) or phenylephrine administration (p=0.89).


The pleth variability index (PVI) represents how much the perfusion index changes during the respiratory cycle. The perfusion index (PI) is determined by the plethysmographic waveform amplitude. This study measured the PVI and PI in 85 women undergoing elective cesarean delivery under spinal anesthesia and found that although the PI was not different, the PVI was higher in patients who experienced hypotension than in those who did not (p<0.05). Further, although PVI was related to the incidence of hypotension (p=0.017), it was not related to the magnitude of the decrease in systolic blood pressure. The optimal threshold value of PVI was 23.5 at which level the sensitivity would be 47.5% and the specificity 87.5% which resulted in a positive predictive value of baseline PVI predicting hypotension to be 80.0% and the negative predictive value 61.4%.

**Fluid Administration**


This study administered 750mL of warm Lactated Ringers to healthy parturients in the preoperative holding area and then measured known endothelial glycocalyx biomarkers via a venous blood draw as well as cardiac parameters via thoracic impedance cardiography. From before to after the bolus, there was a significant increase in the endothelial glycocalyx biomarkers heparan sulfate (p = 0.0098) and syndecan-1 (p=0.045) indicating that a prophylactic fluid bolus disrupts the endothelial glycocalyx. Of note, atrial natriuretic
peptide underwent a non-significant increase (p=0.293) with the bolus, and cardiac parameters changed only slightly: cardiac index increased by 0.1 L/min/m² (p=0.0005), and systemic vascular resistance decreased by 30.7 dyn.s/cm² (p=0.0025). The authors conclude that “because of the endothelial glyocalyx’s importance in modulating transvascular fluid exchange, the potential disruption of (it)… may be counterproductive with respect to maintaining intravascular volume in normovolemic parturients.”


This multicenter double-blind study involved women undergoing spinal anesthesia for elective caesarean delivery with phynylephrine-bolus-based hypotension prophylaxis. Women were randomized to receive a preload of either 500mL of 6% hydroxyethyl starch (n=82) or 1000mL of lactated Ringer’s (n=85). The primary outcome was the incidence of systolic arterial pressure less than 80% of baseline. Although there was no significant difference in total phynylephrine requirements, the incidence of hypotension was significant lower in the hydroxyethyl starch group (36.6% versus 55.3% (p=0.025) as was the incidence of symptomatic hypotension (3.7% versus 14.1%). Six umbilical cord blood samples did not detect any hydroxyethyl starch in the neonatal blood, and neonatal outcomes were comparable.


This double-blind study involved women undergoing spinal anesthesia for elective cesarean delivery with ephedrine-based treatment for hypotension. Women were randomized to receive a preload of 500mL of 6% hydroxyethyl starch (n=103) or a co-load of 1000mL Ringer’s acetate solution (n=102). Although trends were in favor of the colloid preload, there were no significant differences in the incidence of hypotension (p=0.18), severe hypotension (p=0.31), median ephedrine dose (p=0.035), maternal nausea or vomiting, or neonatal outcome. The authors concluded that “neither technique can totally prevent hypotension and should be combined with vasopressor use.”

**Prophylactic phenylephrine infusions**


This systematic review included 21 randomized controlled trials (n = 1504) which compared either a prophylactic phenylephrine infusion to a placebo infusion; a prophylactic phenylephrine infusion to an ephedrine infusion; or a prophylactic phenylephrine infusion combined with ephedrine versus ephedrine alone for women undergoing cesarean delivery under spinal anesthesia. The primary outcome was the rate of maternal hypotension (defined as SBP <80% baseline in all but 5 studies). The authors found evidence that prophylactic phenylephrine infusions reduced the risk of hypotension induced by spinal bupivacaine before cesarean delivery [Relative Risk of hypotension with phenylephrine infusion was 0.36 (0.18-0.73) versus placebo, p=0.004; 0.58 (0.39-0.88) versus an ephedrine infusion, p=0.009; and 0.73 (0.55-.96) when phenylephrine was added to an ephedrine infusion, p=0.02]. Prophylactic phenylephrine infusions also reduced the risk for nausea and vomiting. Pooled data indicated that intrathecal bupivacaine doses of 10mg, 12mg and 14mg were more likely to induce hypotension than doses less than 9mg decreasing phenylephrine’s effect at the lower doses. The authors state that there was no evidence that a phenylephrine infusion reduced other maternal or neonatal morbidities. Therefore, the authors recommend the efficacy of prophylactic phenylephrine infusions be explored with a “large double-blind randomized controlled trial with sufficient power… with an emphasis on important maternal and neonatal outcomes.”


*Accompanied by editorial:*

Ngan Kee WD: Phenylephrine infusions for maintaining blood pressure during spinal anesthesia for cesarean delivery: finding the shoe that fits. Anesthesia and analgesia 2014; 118: 496-8

This prospective trial randomized 80 patients to either a variable-rate phenylephrine infusion (titrated to arterial blood pressure and heart rate) with rescue phenylephrine boluses, or no phenylephrine infusion and just rescue phenylephrine boluses. Their primary
outcome was the number of rescue phenylephrine boluses. All patients received a 15mL/kg crystalloid co-load. The phenylephrine infusion group was initiated at 0.75mcg/kg/min phenylephrine and reduced or increased by 0.25mcg/kg/min if hypertension or hypotension greater than 20% from baseline was noted respectively. When the infusion was increased, a 100mcg bolus phenylephrine infusion was also administered. The group that did not get a phenylephrine infusion followed this same protocol, but administered saline, instead of phenylephrine via the phenylephrine pump. If bradycardia ≤50 bpm developed, the infusion was stopped until the bradycardia resolved and atropine was administered if the patient was hypotensive. In the phenylephrine infusion group, the median number of phenylephrine rescue boluses was 0 (range 0 to 6) and in the no-infusion group was 3 (range 0-9), therefore there was a median difference of 3 [95% CI 2-4] in the number of phenylephrine rescue boluses. Further, the phenylephrine infusion group had a lesser incidence of hypotension [8/40 (20%) vs 35/39 (90%), p<0.001], a greater incidence of hypertension [6/40 (15%) vs 0/30 (0%), p=0.026], and a lesser incidence of nausea and vomiting [4/40 (10%) vs 17/39 (44%), p=0.001]. The authors conclude that “prophylactic variable rate phenylephrine infusion and rescue phenylephrine bolus dosing is more effective than relying on rescue phenylephrine bolus dosing with respect to limiting clinician workload and maternal symptoms during spinal anesthesia for cesarean delivery.” This article is accompanied by an insightful editorial by one of the pioneers of phenylephrine infusions for cesarean delivery, Dr. Warwick Ngan Kee. It discusses how, for cesarean delivery under spinal anesthesia, the “debate has now shifted from whether we should use phenylephrine to how we should use it.” Regarding the mode of delivery, Dr. Ngan Kee states that “one shoe will never fit all.” He states that practices, patients, clinical scenarios and providers are all different and that in normal clinical practice strict protocols as are performed in studies are likely not necessary. Instead, he recommends an initial rate at the time of intrathecal injection of 50mcg/min or 0.75mcg/kg/min and then titration of the infusion based on both blood pressure and heart rate. He concludes his editorial stating, “Ultimately anesthesia providers should be able to develop a phenylephrine regimen based on their local experience that provides an acceptable balance between the elimination of maternal symptoms and the risks of hypertension and bradycardia.”

Cesarean delivery and hypothermia

This study evaluated whether newborns get hypothermic when placed on their mother’s chest during the cesarean delivery surgical closure. They enrolled 40 women who were scheduled for a term elective cesarean delivery. Women were randomized to either a forced-air active warming cover (n=21) covering their naked baby on their bare chest or a prewarmed cotton blanket (n=19) covering their naked baby on their bare chest. All women had spinal anesthesia, all fluids were warmed, and all operating rooms were kept at 23 degrees Celsius. Maternal and neonatal temperatures were checked at the beginning and end of the 20 minute skin to skin session. In the active warming group, at the end of the 20 minutes, maternal core and skin temperature was higher and their rating of thermal comfort was superior. Most importantly though, in the active warming group, only 1 out of 19 (5%) neonates became hypothermic, while in the cotton blanket group, 17 out of 21 (81%) neonates became hypothermic (p<0.0001). This study emphasizes the need to assess one’s institutions skin-to-skin practice in regards to neonatal hypothermia. If neonatal hypothermia is a problem, then forced air warming may be a solution.


In this prospective randomized control trial, 116 women were randomized to either intraoperative warming with a warming mattress or control. The authors found that the incidence of hypothermia (defined as a temperature less than 36.0°C) in the control group was 19.0%. The incidence of hypothermia in their warming mattress group was significantly lower at 5.2% (p = 0.043). Interestingly, there was a significantly lesser mean hemoglobin change in the mattress-warmed group (-1.1 ± 0.9 g/dL versus -1.6 ± 0.9 g/dL, p=0.007). Between the two groups, there was no difference in shivering, Apgar scores, time to breastfeeding, or length of hospital stay.

Oxytocin

This retrospective study reported estimated blood loss, vasopressor administration, and supplemental uterotonic use before and after an oxytocin infusion protocol was initiated during cesarean delivery. Before the protocol, a free-flowing infusion of oxytocin at a concentration of 10U/500mL was initiated through a 16 or 18 gauge IV catheter after cord clamping. The concentration was doubled (20U/500cc) and additional bags were hung per the obstetrician’s and anesthesiologist’s discretion. The protocol involved the initiation of an oxytocin infusion of 18U/hour after cord clamping which was titrated upward as needed. This could be doubled to 36U/hour in the event of atony. After completion of the first hour of the infusion, a maintenance infusion of 3.6U/hour was continued until
discharge from the postpartum unit. Data from 901 cesarean deliveries revealed that total intraoperative oxytocin pre-protocol was 20U (20-30U) and post-implementation was 12.5U (9-18U), which was a median difference of 8.4 U (95% CI 7.4 to 9.4 U). There were no statistical differences in vasopressor administration, estimated blood loss, or supplemental uterotonin use. These authors concluded that “an oxytocin management protocol reduced the amount of intraoperative oxytocin without increasing the rate of postpartum hemorrhage or need for additional uterotonins.”


These authors worked to determine the intravenous dose of carbetocin required to produce effective uterine contraction in 90% of females (ED90) undergoing elective cesarean delivery under spinal anesthesia through a double-blind dose-finding study. The initial dose was 10 mcg, with increments/decrements of 5 mcg. The ED90 of carbetocin was 14.8 mcg (95% CI 13.7 - 15.8) which the authors state is less than one-fifth the currently recommended dose of 100mcg.

Postoperative pain and recovery


This prospective, observational cohort study utilized a revised Short-Form McGill Pain Questionnaire to evaluate the incidence of persistent pain and chronic pain in more than 300 women after Cesarean Delivery. The subjects were given a spinal anesthetic (bupivacaine/fentanyl/morphine), received a standardized surgical protocol, and received multi-modal postoperative analgesia. Data were collected by scripted telephone interview at 8 weeks, 6 months, and 12 months post-delivery. The incidence of chronic pain at 6 months (3%) and 12 months (0.6%) is much lower than previous reports. Although the authors found a low incidence of chronic pain, as many as 22% of patients did report other symptoms such as “numbness” and “tenderness” at 12 months when specifically asked. The authors confirmed previous work on the impact of acute pain on chronic pain by showing that acute postoperative pain in this study was associated with persistent pain symptoms 8 weeks after cesarean delivery.


This meta-analysis aimed to evaluate which epidural opioid, when used in a continuous infusion, results in the best outcomes for postoperative analgesia. They included a total of 24 trials, with most of the studies looking at abdominal or orthopedic surgery; only two studies were of cesarean delivery. Most of the 24 trials focused on morphine versus fentanyl or fentanyl versus sufentanil. Their primary outcome was VAS scores for pain. There was no difference in VAS scores for pain at any time from 0-72 hours post-op when looking at pooled data. The authors concluded that there were no convincing or clinically meaningful differences in analgesia or opioid consumption among the opioids studied. Fentanyl caused less PONV than morphine (OR 1.91; 95% CI 1.14-3.18) and perhaps less pruritus (OR 1.64; 95% CI 0.98-2.76; not statistically significant). There was significant heterogeneity among the 24 trials reviewed.


This systematic review and meta-analysis evaluated the effectiveness of chewing gum after Cesarean delivery in preventing postoperative ileus. Seven RCTs involving 1462 (728 in chewing gum groups, 734 in control) women were included. Of the 3 trials looking specifically at postoperative ileus, chewing gum was associated with significantly fewer occurrences of ileus (OR 0.36; 95% CI 0.19-0.69, p <0.002). There were also reductions in time to first flatus, time to first bowel sounds, and time to first defecation. There was significant heterogeneity in the clinical and methodological conduct of the studies. The authors recommend chewing gum for 30-60 minutes at least 3 times a day because this was studied by a majority of the trials. This appears to be effective in reducing the incidence and consequences of ileus following cesarean delivery, although the authors admit that the strength of supporting evidence is weak.

TAP block and wound infiltration

This double-blind trial randomized women (n=73) undergoing cesarean delivery with a multimodal analgesic regimen which included intrathecal morphine to either bilateral ultrasound-guided TAP blocks with 20cc of 0.25% ropivacaine per side, or a sham procedure with saline. At 24 hours, there were no significant differences between the groups in postoperative pain (pain at rest, p=0.4; pain after movement, p= 0.08) the Quality of Recovery-40 questionnaire (p=0.17) or opioid consumption (p=0.61). Interestingly, although not statistically significant, there were trends in the Ropivacaine TAP block group for lower pain scores at 2 hours, but higher postoperative pain scores at 24 hours and 48 hours in comparison to the saline group. Similar health and functioning scores (SF-36) at 30 days and 6 months were also reported between groups.


This trial randomized women undergoing cesarean delivery under spinal anesthesia without intrathecal morphine to either postoperative analgesia with bilateral ultrasound-guided transversus abdominis plane block with 20mL of 0.375% levobupivacaine on each side (total 150mg), or continuous wound infiltration with a total of 150mg levobupivacine infused into the wound over the first 24 hours then 12.5mg/hour thereafter. The trial was prematurely terminated secondary to a patient in the TAP block group experiencing a generalized tonic-clonic seizure which was successfully treated with intralipid and supportive care. Therefore, the study was underpowered (n=65) but showed no differences in pain at rest (p=0.4) or during mobilization (p=0.5), no difference in opioid consumption (p=0.09), and no difference in persistent pain at one month (p=0.73).


This case report describes 2 cases of generalized tonic-clonic seizures in patients who had ultrasound guided transversus abdominis plane blocks. One patient had 20mL of 0.375% levobupivacaine on each side (total 150mg) and experienced a seizure 10 minutes after injection, and the other had 20mL of 0.75% ropivcaine (total 300mg) on each side and experienced a seizure 25 minutes after injection. The authors state that these cases “cast a cautionary note for the use of TAP blocks after cesarean delivery” because the “risk of local anesthetic toxicity after the procedure remains unknown.” They also state, “to limit the risk, a low concentration of local anesthetic solution should be chosen when a ‘20mL bilaterally’ regimen is necessary to achieve the required spread for a successful block.”


This double-blind trial randomized women who were scheduled for cesarean delivery under general anesthesia to a bupivacaine-soaked absorbable gelatin sponge placed subcutaneously and supra-fascially in the wound (n=81) or a control group (n=83). All women received multimodal analgesia which included scheduled NSAIDs and acetaminophen, as well as meperidine as needed for breakthrough pain. Pain scores (primary outcome) were lower in the study group at all assessment times—1, 4, 12, 18, 24, 36 and 48 hours (all p <0.001). Secondary outcomes included cumulative analgesic consumption which was lower in the study group (p<0.001) as was the frequency of postoperative nausea, vomiting, antiemetic drug requirement and sedation at both 4 hours and 8 hours (all outcomes p <0.001).


This double-blind trial randomized women undergoing cesarean delivery under spinal anesthesia (without intrathecal morphine) to a suprafascial, subcutaneous multi-orifice surgical wound catheter which administered either 0.75% ropivacaine (n=33) or saline (n=34). The study drug was administered as a 10mL bolus after skin closure followed by 2mL/hr infusion. All women received multimodal analgesia which included scheduled NSAIDs and acetaminophen. The mean amount of oxycodone administered during the first 48 hours (primary outcome) was not significantly different (47.5 ± 20.9mg in the ropivacaine group versus 57.8 ± 29.4mg in the placebo group, p=0.10). There were also no significant differences in pain scores or patient satisfaction scores.
Co-Existing Disease

Obesity


This randomized controlled study (n = 41) compared the time to perform a single shot spinal (SSS) with the time to perform a combined spinal epidural (CSE) technique in patients weighing greater than 100 kg undergoing elective cesarean delivery. The mean body mass index was not different between groups (48.7 ± 7.6 kg/m² for SSS versus 49.9 ± 8.6 kg/m² for CSE) nor was the difference in the median time to perform the techniques [210 (116-592)seconds for SSS versus 180 (75-450) seconds for CSE; p = 0.36]. Total number of attempts was greater in the SSS technique [5 (4-10) SSS attempts versus 3 (1-4) CSE attempts; p = 0.007]. The authors conclude that “the CSE technique is non-inferior to the SSS technique in morbidly obese parturients for time of initiation... and may be accomplished with fewer attempts with experienced residents.”


This study showed that obese parturients had reduced decisional conflict scores (indicating they were more likely to implement a decision) after antenatal consultation. The authors collected data on decisional conflict, anxiety, and risk perception prior to and two weeks after antenatal anesthesia consultation. The mean gestation age at time of consultation was 32.8 weeks. Decisional Conflict Scale (DCS) (30.0 +/- 20.4 vs. 16.5 +/- 12.4, p<0.001) and anxiety (9.4 +/- 3.1 vs. 8.5 +/- 2.8, p = 0.002) scores were significantly lower after the consultation. A DCS score goes from 0 (no conflict) to 100 (highest decisional conflict) and a score of <25 is associated with implementing decisions while a score of >37.5 is associated with decisional delay. Nulliparous women and those who had never before experienced neuraxial anesthesia showed higher baseline DCS scores and were more likely to change their analgesia preference after consultation. While most women found the consultation reassuring, 11% described the consultation as a negative experience a majority of which remained unaware of the anesthetic risks of obesity in pregnancy. The content of the consultation and the person performing the consultation were not standardized. The authors conclude that their results support the practice of referral of parturients with high BMI for anesthetic consultation.


This matched cohort study looking at anesthetic and obstetric outcomes in morbidly obese parturients was modeled after a previous study performed over 20 years ago. The authors compared 230 morbidly obese parturients (>300 lbs) to matched controls. Like previous studies, the authors confirmed that morbidly obese patients are at increased risk for antenatal disease (hypertensive disease of pregnancy, diabetes), failed labor analgesia (17% vs. 3%, p<0.01), longer first stage of labor, and cesarean delivery (50% vs. 32%, p<0.001). Other interesting findings were that the use of neuraxial block during labor was negatively correlated with the risk for cesarean delivery (p<0.0001) and that operative duration did not differ between groups. Finally, in comparing this recent data to their 1993 data, morbidly obese women in this study were significantly less likely to receive a general anesthetic (3% vs. 24%, p<0.01).


This study concluded that obese women were less accurate at identifying the middle of their back than the non-obese women. Initially, 50 non-laboring women (25 with a BMI ≥30, 25 with a BMI <30) were asked to touch the “middle” of their back. Ultrasound was then used to identify the true midline. Only 52% of the obese group were accurate to within 5 mm in identifying their midline by pointing, compared with 84% of non-obese women (p = 0.03). Next, a horizontal line was drawn across the woman’s back at L3-4 and 5-mm markings were made along the line in both directions starting at the midline. A sharp stimulus was applied at each marking with the subject being asked to describe it as being “left”, “right” or in the middle of her back. Obese women displayed a wider discrimination range for sharp stimulus (median 33 [25-45] vs. 18 [13-25], p=0.0001) than non-obese patients, indicating that they were less likely to accurately describe the location of the pinprick stimulus. The authors do comment that based on their results, obese women often will be able to help identify midline during central neuraxial blockade, just not as well as non-obese women.

This study was a secondary analysis of pre-existing data that had previously been used in a prospective cohort observational study looking at the risk of uterine rupture. Data from over 21,000 women undergoing primary (12,832; 60%) or repeat (8,540; 40%) cesarean delivery was evaluated to determine if there were differences in incision-to-delivery and total operative times among women73 stratified into four BMI categories at time of delivery (normal 18.5-24.9, overweight 25.0-29.9, obese 30.0-39.9, morbidly obese 40.0 and greater). Both incision-to-delivery interval and total operative times were significantly longer among overweight (median (IQ) times 9.0 (6.0) and 45.0 (21.0) minutes), obese (10.0 (7.0) and 48.0 (22.0) minutes), and morbidly obese women (12.0 (8.0) and 55.0 (26.0) minutes) when compared to women with normal BMI at delivery (9.0 (5.0) and 43.0 (20.0) minutes, p<0.001). Additionally, the odds for prolonged incision to delivery (18 minutes or longer) were significantly associated with obese BMI (OR 1.62) and morbidly obese BMI (OR 2.81). The authors point out that although the absolute increase in incision-to-delivery interval may not be clinically relevant from most women, the increase in prolonged incision-to-delivery interval likely is.

77. Aune D, Saugstad OD, Henriksen T, Tonstad S: Maternal body mass index and the risk of fetal death, stillbirth, and infant death: a systematic review and meta-analysis. JAMA 2014; 311: 1536-46

This systematic review and meta-analysis was conducted to clarify the association between maternal BMI and risk of fetal death, stillbirth, and infant death. They included 38 different studies from across the world and stratified BMI in increments of 5 BMI units. The relative risk of fetal death per 5 BMI units was 1.21 (95% CI 1.09-1.35, p<0.001) with evidence for a nonlinear association with a steeper curve at the higher levels of BMI. The relative risk of stillbirth was 1.28 (95% CI, 1.15-1.43, p<0.001) per 5 BMI units, and this association appeared to be almost linear. The relative risk of infant death per 5 BMI units was 1.18 (95% CI, 1.09-1.28, p = 0.003). The greatest risk was observed in the category of severely obese women; women with a BMI of 40 had an approximate 2-to-3 fold increase in the RR of these outcomes vs. those with a BMI of 20. However, even modest increases in maternal BMI were associated with increased risk of fetal/infant death and stillbirth. The positive dose-response relationship between increasing maternal BMI and these risks suggests an underlying biological relationship between maternal adiposity and fetal and infant death.

Obstructive sleep apnea


This retrospective cross-sectional analysis of utilized the Nationwide Inpatient Sample database and ICD-9-CM codes to identify patients with obstructive sleep apnea (OSA) as well as determine length of hospital stay, in-hospital mortality and a number of other maternal and neonatal coexisting diseases. The authors found that in 1998 the rate of an OSA diagnosis was 0.7 per 10,000 maternal hospital discharges which climbed to 7.9 per 10,000 in 2009 (average annual increase of 24%). Women with OSA were more likely to be older, non-Hispanic black, low-income, have Medicare/Medicaid, have a previous cesarean delivery, and use tobacco, illicit drugs or alcohol during pregnancy. After attempting to control for these confounders and obesity, OSA was associated with preeclampsia (OR 2.5; 95% CI 2.2 – 2.9), eclampsia (OR 5.4; 95% CI 3.3 - 8.9), cardiomyopathy (OR 9.0; 95% CI 7.5 - 10.9), congestive heart failure (OR 8.9; 95% CI 7.5-10.7), pulmonary edema (OR 7.5; CI 95% 4.6 - 12.2), and pulmonary embolism (OR 4.5; CI 2.3-8.9). Women with OSA had a fivefold increased odds of in-hospital mortality (95% CI 2.4 - 11.5). Early onset delivery but not fetal growth restriction or stillbirth was also associated with OSA.


This metaanalysis systematically review initially including 4386 original studies published up until June 2012 that evaluated the association between gestation hypertension/preeclampsia, gestational diabetes, low birthweight infants and maternal sleep-disordered breathing. Thirty one studies met their criteria and showed the maternal sleep-disordered breathing was significantly associated with gestational hypertension/preeclampsia (5 studies, pooled OR 2.34, 95% CI 1.6-3.09) and gestational diabetes (5 studies, pooled OR 1.86, 95% CI 1.3-2.42). Although individual studies showed low birthweight infants were also associated with maternal sleep-disordered breathing, the way the data were reported in some of these studies and the heterogeneity of data in the remainder did not allow for pooling of data and meta-analysis.

This prospective observation study sought to establish a prevalence of OSA in pregnancy as well as sought to determine the validity of two OSA screening scales in pregnancy (the Berlin Questionnaire and the Epworth Sleepiness Scale) in comparison to polysomnography. A total of 1509 women underwent OSA screening, 456 women (30.2%) screened positive by both questionnaires, and 58 women underwent polysomnography testing (398 women did not complete their referral to the sleep center after screening positive). Of the 58 women who completed their referral, 9 tested positive (15.5% of those tested) and 49 women tested negative. This resulted in an estimated point prevalence of OSA in this pregnant population of 4.9%. Therefore, the questionnaires were poorly predictive of OSA and were associated with a high false referral rate. The authors conclude, “...cautious use of these screening tools in clinical obstetrical practice is warranted.”


This prospective observational study explored the association between OSA and hypertensive disorders of pregnancy and small-for-gestational-age infants. The authors screened 1157 pregnant women of all gestational ages for OSA with the Berlin Questionnaire and the Epworth Sleepiness Scale and referred those that screened positive on for polysomnography. Screening positive on the Berlin Questionnaire was associated with hypertensive disorders of pregnancy (adjusted RR= 1.90, 95% CI 1.52-2.37) but not small for gestational age infants. This association between screening positive on the Berlin Questionnaire and hypertensive disorders held true for both obese and non-obese women. The Epworth Sleepiness Scale was not associated with any outcomes which the authors explained by hypothesizing that the frequency of sleepiness in pregnancy may make it a poor screening symptom for OSA in pregnancy.


This prospective observational study recruited women (n=182) at high risk for sleep disordered breathing and looked for its association with preeclampsia, gestational diabetes, preterm birth, and infant weight. All the patients had either a BMI > 30 kg/m² or greater, chronic hypertension, pregestational diabetes, prior preeclampsia, and/or a twin gestation. They had initial polysomnography testing between 6 and 20 weeks and repeat testing between 28 and 37 weeks. Those that tested positive were categorized according to their apnea hypopnea index as mild, moderate or severe. There were no relationships demonstrated between sleep disordered breathing and preeclampsia, preterm birth, or extremes of birthweight. There was a dose-dependent relationship between sleep disordered breathing and the subsequent development of gestational diabetes. In the absence of sleep disordered breathing, 25% of the cohort subsequently developed gestational diabetes, among those with mild sleep disordered breathing 43% developed diabetes, and among those with moderate/severe sleep disordered breathing 63% developed gestational diabetes (p=0.03), which calculates to an adjusted odds ratio for developing gestational diabetes for those with moderate to severe sleep disordered breathing of 3.6 (95% CI 0.6 – 21.8).

83. Practice guidelines for the perioperative management of patients with obstructive sleep apnea: an updated report by the American Society of Anesthesiologists Task Force on Perioperative Management of patients with obstructive sleep apnea. Anesthesiology 2014; 120: 268-86

This practice guideline for the perioperative management of patients with obstructive sleep apnea does not specifically address the management of obstetric patients. It does make statements that could be interpreted to include patients with OSA undergoing cesarean delivery. For example, it states "the benefits (improved analgesia, decreased need for systemic opioids) and risks (respiratory depression from rostral spread) of using an opioid or opioid-local anesthetic mixture rather than local anesthetic alone should be weighed.” It also states that “to reduce opioid requirements, nonsteroideal anti-inflammatory agents and other modalities... should be considered if appropriate,” and delineates that importance of appropriate postoperative monitoring stating patients with OSA “should not be discharged from the recovery area to an unmonitored setting (i.e., home or unmonitored hospital bed) until they are no longer at risk of postoperative respiratory depression.”

Cardiac disease

This population prevalence study from 2000 to 2009 utilized the Nationwide Inpatient Sample to identify pregnant women who were admitted for delivery and their prevalence of cardiomyopathy. The prevalence increased from 0.25 per 1000 deliveries in 2000 to 0.43 per 1000 deliveries in 2009 (p< 0.0001). Women with chronic hypertension were at increased odds of developing cardiomyopathy (OR 13.2; 95% CI 12.5-13.7). Notably, chronic hypertension amongst parturients increased linearly over the 10-year period and was the single identified pre-existing medical condition that explained the increasing prevalence of cardiomyopathy at delivery (p=0.005 for the differences in slopes for linear trends). Of note, the prevalence of cardiomyopathy at delivery did not change for women who did not have chronic hypertension.


These authors evaluated the umbilical cord blood from both women with (n=33) and without (n=44) congenital heart disease undergoing elective cesarean delivery. All women underwent CSE anesthesia. Lower umbilical arterial blood pH, lower base excess and lower bicarbonate levels were present in the cord blood of pregnant women with CHD than in healthy women.

**Chronic Hypertension**


This systematic review includes retrospective cohorts, prospective cohorts, population studies and appropriate arms of randomized controlled trials to pool pregnancy outcomes of 795,221 pregnancies complicated by chronic hypertension. The authors then compare these outcomes to the outcomes of the US general population from the National Vital Statistics Report of 2006. In comparison, women with chronic hypertension had an increased risk of preeclampsia (RR 7.7; 95% CI 5.7 – 10.1), cesarean delivery (RR 1.3, 95% CI 1.1-1.5), preterm delivery < 37 weeks (RR 2.7, CI 1.9 – 3.6), birth weight <2500g (RR 3.2, CI 2.2 – 4.4), neonatal intensive care unit admission (RR 3.2, CI 2.2 – 4.2), and perinatal death (RR 4.2, CI 2.7 – 6.5). There was heterogeneity in the reported incidences of all outcomes ($r^2 = 0.286 -0.766$).

**Preeclampsia**


This retrospective cohort study evaluated all hospital deliveries in Canada (excluding Quebec) between 2003 and 2010 (n=2,193,425) for the incidence of obstetric acute renal failure. Rates of obstetric acute renal failure rose from 1.66 to 2.68 per 10,000 deliveries between 2003- 04 and 2009-10 (61% increase, 95% CI 24% to 110%). Adjustment for postpartum haemorrhage and other factors did not attenuate the increase. The temporal increase in acute renal failure was restricted to deliveries with hypertensive disorders. There was no significant increase among women without hypertensive disorders.


This prospective cohort study enrolled 20 consecutively admitted patients with severe preeclampsia (previous ACOG definition) and 20 healthy parturients, and performed lung and cardiac ultrasound evaluations before and after delivery. Lung edema (as determined by “multiple B-Lines” or “comet tails” on lung ultrasound) was found in 5 (25%) of the patients with severe preeclampsia. Overall, in comparison to healthy parturients, parturients with severe preeclampsia had lung ultrasounds that showed an increased Echo Comet Score (31 versus 0%, p=0.02), an increased B-pattern (25 versus 0%, p=0.047), an increased lung ultrasound score (7 versus 1, p<0.001), and an increased rate of posterior basal lung consolidation (35 versus 0%, p=0.01). Likewise, parturients with severe preeclampsia had echocardiography that showed diastolic dysfunction with an increased $E$ wave velocity (97 versus 79 cm/s, p=0.03), an increased $E/E′$ ratio (7.9 versus 6.6, p=0.04), and higher velocity-time index values (21 vs 17 cm, p=0.002). Interestingly, the authors found a linear correlation between the $E/E′$ ratio and the number of $B$-lines quantified by the Echo Comet Score ($r=0.66$, p<0.001), a linear relationship between the $E$ wave velocity and the Echo Comet Score ($r=0.36$, p=0.018), and that increased LVEDP ($E/E′ > 9.5$) was associated with an increased Echo Comet Score (95 vs 20, p <0.001). These findings imply a degree of validity to the lung ultrasound test when used in preeclampsia to determine the extent of pulmonary edema. The authors state that this simple test could help guide fluid management in parturients with severe preeclampsia and call for large investigations to determine its usefulness.

This review summarizes the literature on drugs that have been used to attenuate the hypertensive response to laryngoscopy in preeclamptic patients. The evidence is summarized in a table which includes each drug’s onset, duration, fetal to maternal ratio, its neonatal effects, maternal side effects, whether there is data available in preeclamptic patients and the doses studied. The authors emphasize the scant literature available on the use of propofol for this purpose. The authors discourage the use of a magnesium bolus, lidocaine, calcium channel antagonists other than nicardipine, and hydralazine to prevent peri-induction hypertension. The authors state that they utilize esmolol 1.5mg/kg or nitroglycerine 2mcg/kg combined with propofol 2mg/kg depending on the maternal hemodynamic variables at the time. They also state that labetalol, remifentanil and nicardipine are reasonable options, but data is lacking on nicardipine.

Medication Use in Pregnancy


The National Center on Birth Defects and Developmental Disabilities (NCBDDD) of the CDC brought together a multidisciplinary panel of experts to develop “a strategy to prioritize, synthesize, evaluate and disseminate the body of evidence on the comparative safety” of various drugs used in pregnancy. The product of the convention is a prototype of a formal review process that will occur to evaluate the quality and strength of the evidence regarding the pharmacologic treatment of various maternal conditions.

Opioid Use in Pregnancy


This retrospective cohort study utilized data from the Medicaid Analytical eXtract for 46 U.S. states and Washington, D.C. for the period from 2000-2007 which involved 1.1 million women with completed pregnancies. The authors identified women who filled prescriptions for opioid analgesics using pharmacy-dispensing claims and found that 21.6% (239,381 out of 1,106,757) of pregnant women filled at least one opioid prescription during their pregnancy. The main diagnoses for women receiving the opioid prescriptions were abdominal pain (48.4%), lower back pain (33.0%), headache syndromes (13.3%), joint pain (11.2%) and migraine (7.9%). Overall, 11.1% of pregnant women filled prescriptions for codeine, 10.0% for hydrocodone, 2.9% for propoxyphene and 2.2% for oxycodone. There were substantial regional differences ranging from 9.3% of pregnant women filling opioid prescriptions in the Northeast to 35.8% of pregnant women filling opioid prescriptions in the South. Utah had the highest rate of opioid prescriptions with 41.6% of women filling an opioid prescription during pregnancy. Interestingly, the proportion of pregnant women filling an opioid prescription increased between 2000 and 2007 from 18.5% to 22.8% (p value for the test of linear trend <0.001).


Accompanied by editorial:
Flood P, Raja SN. Balance in Opioid Prescription during Pregnancy. Anesthesiology 2014; 120:1063-4

This retrospective review abstracted data from the Nationwide Inpatient Sample which included 56,900,512 delivery admissions between 1998 and 2011 in the United States. The authors found that the prevalence of opioid abuse or dependence increased by 127% during that time period—from 1.7 per 1,000 delivery admissions in 1998 to 3.9 per 1000 delivery admissions in 2011 (P for trend is <0.001). The authors analyzed the data between 2007 and 2011 for adverse outcomes while controlling for age group, race, primary payer, previous cesarean delivery, multiple gestation, and maternal preexisting conditions and found that opioid abuse and dependence increased the odds of maternal in-house mortality (adjusted OR 4.6, 95% CI 1.8-12.1), maternal cardiac arrest (adjusted OR 3.6, 95% CI 1.4-9.1) intraterine growth restriction (adjusted OR 2.7, 95% CI 2.4-2.9), placental abruption (adjusted OR 2.4, 95% CI 2.1-2.6), preterm labor (adjusted OR 2.1, 95% CI 2.0-2.3), oligohydramnios (adjusted OR 1.7, 95% CI 1.6-1.9), blood transfusion (adjusted OR 1.7, 95% CI 1.5-1.9), stillbirth (adjusted OR 1.5, 95% CI 1.3-1.8), premature preterm rupture of membranes (adjusted OR 1.4, 95% CI 1.3-1.6), and cesarean delivery (adjusted OR 1.2, 95% CI 1.1-1.3). Although the risk of anesthesia complications was increased, it did not reach statistical significance (adjusted OR 2.1, 95% CI 0.8-5.3).

Addiction

These authors searched seven databases for studies on perioperative management of patients addicted to alcohol and drugs. Although a limited number of publications exist in the obstetric population, these studies focus on addiction management during pregnancy and do not address peripartum analgesic requirements. Although the authors provide recommendations for the perioperative and peripartum care of addicted patients, they admit that clinical trials are sparse and the physiologic and affective factors that impact perioperative/peripartum management remain poorly understood.

Major Mental Disorders

This opinion was published by psychiatrists, ethicists, and obstetricians and proposes an algorithm for the management of parturients with major mental disorders during labor and delivery. The algorithm asks 5 questions: 1) Does the patient have the capacity to consent to treatment? 2) Is there time to attempt restoration of capacity? 3) Is there an opportunity for substituted judgment? 4) Is the patient accepting treatment? 5) Is there an opportunity for active assent? If the above 5 questions are “no,” then the algorithm recommends “coerced clinical management as the least worst” alternative.

Infectious Disease

This commentary published by Centers for Disease Control and Prevention gives obstetricians background and guidance regarding caring for pregnant patients who could potentially have Ebola. These experts state that “limited evidence suggests that pregnant women are at increased risk for severe illness and death when infected with Ebola Virus.” They also state that pregnant women with Ebola are at an increased risk for spontaneous abortion and pregnancy-associated hemorrhage and neonates born to mothers with Ebola Virus have not survived. The authors suggest screening of all patients presenting to labor and delivery units regarding travel in West Africa in the past 21 days, and if a pregnant woman screens in positive and ultimately is diagnosed, then the clinical guidance would be the same as for nonpregnant adults, “with an emphasis on monitoring and early treatment of hemorrhagic complications.” They also remind providers to observe all prevention precautions for the neonates born to these women.


This letter to the editor presents the declining admissions to the Matam Maternity Hospital in Conakry, Guinea (904 admissions between January 2014 and March 2014 and only 123 admissions between July 2014 and September 2014). The authors believe this is a result of women fearing contraction of the Ebola virus at a health facility. As a result, the authors state, “we are concerned that women in need of reproductive health care because of pregnancy, childbirth, and post-partum related complications, including hemorrhage, eclampsia, obstructed labor, and abortion, will not have the necessary and even life-saving care and attention.” They go on to state that the United Nations Population Fund “estimates that 15% of the 800,000 women who will give birth in the next 12 months in Guinea, Liberia, and Sierra Leone could die of complications because of inadequate emergency obstetric care...”


Because ritonavir is known to decrease fentanyl clearance in human volunteers, this study simulated the effect the antiretroviral drug ritonavir had on plasma fentanyl concentrations during epidural labor analgesia. The authors modeled the “worst case scenario” that could compromise patient safety. They posited the administration of an 80mcg fentanyl bolus over the first 20 minutes of epidural analgesia followed by one of six PCEA regimens which included infusions ranging between 16 and 24 mcg/hour fentanyl with 16mcg bolus doses every 20 minutes, and in some scenarios, an additional 100mcg fentanyl bolus. They utilized the most detailed pharmacokinetic description of drug absorption from the epidural space. The results of the simulations showed that in spite of ritonavir-induced CYP2A4 inhibition of fentanyl metabolism, no scenario produced plasma fentanyl concentrations that are known to be associated with a 50% decrease in minute ventilation.

Accompanied by editorial:
Edwards MS. Adverse fetal outcomes: expanding the role of infection. JAMA; 311: 1115-6

This retrospective study determined the epidemiology of invasive Haemophilus influenzae between 2009 and 2012 in England and Wales. The National Health Service laboratory provided all isolated H. influenzae cases and Public Health England sent questionnaires to the general practitioners that cared for the patients. Among 45,215,800 woman-years, 2568 cases if invasive H. influenzae were identified, 171 women had invasive H. influenzae, and 75 of the women infected were pregnant at the time of infection. The authors calculate that the incidence of invasive unencapsulated H. influenzae was 17.2 (95% CI, 12.2-24.1, p<0.001) times greater in pregnant compared to nonpregnant women. They also found that unencapsulated H. influenzae infection during the first 24 weeks of pregnancy was associated with fetal loss or extremely premature birth, and in the second half of pregnancy was associated with premature birth and stillbirth. The authors conclude that in cases of intrapartum sepsis, intrauterine death, septic abortion, or premature rupture of membranes that vaginal and placental samples should be routinely tested using culture media that support the growth of H. influenzae.

Morbidity and Mortality

OB anesthesia quality and safety


Accompanied by editorial:
Bateman BT, Tsen LC: Anesthesiologist as epidemiologist: insights from registry studies of obstetric anesthesia-related complications. Anesthesiology 2014; 120: 1311-2

The Serious Complication Repository Project of the Society for Obstetric Anesthesia and Perinatology incorporated 30 institutions over a 5 year period during which time quality reports from each institution was sent into a central repository with the goal of establishing the incidences and the risk factors associated with serious complications in obstetric anesthesia. The researchers captured 257,000 anesthetics and reported 157 total serious complications [incidence 1:1,959 (95% CI 1,675 – 2,294)]; 85 of which were anesthesia related [incidence 1:3,021 (95% CI 2,443 - 3,782)]. Among all the complications, the incidence of maternal death was 1:10,250 (95% CI 7,180 – 15,192); cardiac arrest 1:7,151 (95% CI 5,319 – 9,615); myocardial infarction 1:153,748 (95% CI 42,562 – 1,269,541); serious neurologic injury 1:11,389 (95% CI 7,828-17,281); anaphylaxis 1:61,499 (95% CI 26,353– 189,403); and respiratory arrest in the labor suite 1:8,455 (95% CI 5,714 – 12,500). Specifically for anesthesia-related complications, there were no maternal deaths and the following incidences calculated: cardiac arrest 1:128,393 (95% CI 35,544 – 1,060,218); myocardial infarction 1:128,393 (95% CI 35,544 – 1,060,218); epidural abscess/meningitis 1:62,866 (95% CI 25,074 – 235,620); epidural hematoma 1:251,463 (95% CI 46,090 – 10,142,861); serious neurologic injury 1:35,923 (95% CI 17,805 – 91,244); failed intubation 1:533 (95% CI 290 – 971); high neuraxial block 1:4,336 (95% CI 3,356– 5,587); respiratory arrest in the labor suite 1:10,402 (95% CI 6,172 – 16,131); and unrecognized spinal catheter 1:15,435 (95% CI 9,176 – 25,634). Interestingly, there were no cases of aspiration reported. The authors were not able to comment on risk factors because of the low number of events. The editorial that accompanies the article authored by Dr. Brian Bateman emphasizes the reassuringly low rates of epidural hematoma, infection or serious neurologic injury, but highlights the maternal deaths that occurred in about 1 out of every 10,000 deliveries (consistent with U.S. estimates) with hemorrhage being the leading cause of both arrest and death. Dr. Bateman calls for anesthesiologists to play a role in reducing the rate of maternal mortality in the United States and actively transition to the role of “peri-delivery physicians” drawing on our operative and critical care experience to manage high risk and critically ill parturients.


These authors designed an experimental “Anesthesia Complication Quality Indicator” specific to childbirth using the methodology of the Agency for Healthcare Research and Quality (AHRQ), Patient Safety Indicators (PSI). They then used the California hospital discharge data to calculate hospital-specific rates, adjusting for age, race, and pregnancy complications. Among 508,842 deliveries in 254 California hospitals, the rate of anesthesia complications was 0.31%. Note that this was greater than the standard AHRQ population which included all surgery types whose rate was 0.13%. Stratified by mode of delivery, anesthesia childbirth complication rates were 0.49% for caesarean
delivery and 0.22% for vaginal delivery (p<0.0001). The authors found that 13 hospitals were in the upper quartile of outliers with adjusted rates from 0.52% to 2.13%. They conclude that a childbirth-related AHRQ PSI could “identify hospitals with extreme complication rates that may provide insights into systematic ways to improve patient safety.”

**OB quality and safety**


These authors describe their experience with a comprehensive patient safety program at Yale-New Haven Hospital that was successful in reducing their liability claims and payments over the 10-year period while the state of Connecticut claims and payments did not reduce. Their effort included an outside expert review, increased use of protocols and guidelines, the hiring of an obstetric safety nurse, the advent of anonymous event reporting, the introduction of obstetric hospitalists, the creation of an obstetric patient safety committee, the annual use of a Safety Attitude Questionnaire, required team training, and electronic fetal heart rate certification.


This observational study examined the New York City hospital discharge and birth certificate data sets from the year 2010 and examined whether maternal and neonatal morbidity had any association to the two current Joint Commission obstetric quality indicators: 1) non-medically indicated deliveries between 37 and 39 weeks gestation and 2) cesarean delivery performed in low-risk mothers. Maternal morbidity occurred in 2372 of 115,742 deliveries (2.4%) and neonatal morbidity occurred in 8,057 of 103,416 term newborns without anomalies (7.8%). Neither of the maternal quality indicators was associated with severe maternal or neonatal complications. The risk ratio for elective delivery before 39 weeks was 1.00 (95% CI 0.98-1.02) for maternal morbidity and 0.99 (95% CI 0.91-1.01) for neonatal morbidity. The risk ratio for cesarean delivery performed in low-risk mothers was 0.99 (95% CI 0.96-1.01) for maternal morbidity and 1.01 (95% CI 0.99-1.03) for neonatal morbidity. The authors conclude that there were no correlations between the Joint Commission quality indicators and maternal and neonatal complications.


This qualitative interview study involved 35 women and 11 of their partners who had experienced a severe life-threatening complication in pregnancy such as uterine rupture, amniotic fluid embolism, massive hemorrhage or severe sepsis. The subjects were interviewed regarding their experiences and key factors were identified by women which they associated with good-quality care. These included small, personal touches and reassurances from doctors and nurses during the event itself (examples included hand-holding and telling patients they were going to be okay); constant communication with a health professional for both the woman and her family during the event itself (explaining what was going on); sensitivity to a postpartum woman’s emotional, physical and breastfeeding needs after childbirth, even in the intensive care unit; the ability to communicate with healthcare professionals afterwards and to go through the notes regarding the event to help women make sense of the experience; the ability to recognize the long-lasting mental health impacts and offer counselling resources to patients.

104. Callaghan WM, Grobman WA, Kilpatrick SJ, Main EK, D’Alton M: Facility-based identification of women with severe maternal morbidity: it is time to start. Obstetrics and Gynecology 2014; 123:978-81

This commentary discusses the importance of hospitals defining “severe maternal morbidity” and reviewing the care of patients that meet the definition in order to improve patient safety. The authors propose the transfusion of 4 or more units of blood products and/or admission to the intensive care unit as a starting point for helping hospitals identify women who may have experienced severe maternal morbidity to allow for subsequent case investigation which would thereby allow hospitals to identify failures within their systems.


This expert opinion presents guidance for a standardized severe maternal morbidity interdisciplinary review process to identify system, professional, and facility factors that can be ameliorated, with the overall goal of improving institutional obstetric safety and reducing severe morbidity and mortality among pregnant and recently pregnant women. The authors discuss the review committee’s organization,
the review process, the medical record abstraction and assessment, the review culture, the data management, the review timing, and the review confidentiality.


This author’s editorial calls for state-based identification and investigation into maternal deaths in order to better understand the causes of and risk factors for maternal death. The author states that many states do not currently review maternal deaths. Callaghan discusses identifying maternal deaths, deciphering which of these are potentially preventable, and then utilizing a state’s department of health to improve systems of care to prevent such maternal deaths in the future.

Severe maternal morbidity and mortality in developed countries


This study is a secondary analysis of data from the “Assessment of Perinatal Excellence” cohort from the Eunice Kennedy Shriver National Institutes of Child Health and Human Development Maternal-Fetal Medicine Units Network. It involved 115,502 deliveries between 2008 and 2011 that occurred in 25 hospitals in the United States. The authors created a scoring system to classify severe morbidity which included unanticipated surgical intervention (1 point), intubation for more than 12 hours (2 points), red blood cell transfusion greater than 3 units (3 points), admission to the ICU (4 points), failure of at least one organ system (5 points). Overall, 332 women (2.9/1000 births, 95% CI, 2.6-3.2) had a total of 8 or more points which classified them as experiencing severe morbidity. The primary etiology was determined to be as follows: Postpartum hemorrhage (n=158, 47.6%), hypertension complications (n=68, 20.5%), acute cardiopulmonary complications such as cardiomyopathy, cardiac arrest, ARDS, or pulmonary edema (n = 63, 19.0%), infection (n=20, 6.0%), preexisting maternal medical conditions (n=8, 2.4%), trauma (n=4, 1.2%), acute neurologic complications (n=3, 0.9%), iatrogenic events (n=2, 0.6%), and pregnancy specific conditions such as acute fatty liver or amniotic fluid embolism (n = 2, 0.6%). Patient factors associated with severe morbidity included placenta accreta, antenatal anticoagulation, cigarette use, hypertension, diabetes, abruptio placentae, and prior cesarean delivery.


This case-control study at the University of Alabama at Birmingham reviewed all maternal deaths between 1990 and 2010 in order to determine if pregnant women who were African American were more likely to die than Caucasian women. Each maternal death was matched 1:2 with women who did not die and delivered as close as possible to the same time. The data did not suggest racial disparity in maternal deaths with the proportion of African American women in the maternal death group at 57% (42 of 77) and in the control group 61% (94 of 154) (p=0.23). The authors also reported that secondary analysis showed no significant association of mortality with insurance status, income, BMI, marital status, or parity. There was a significant difference between case and control patients in the residence-to-hospital distance, gestational age, fetal survival, duration of hospital stay, lack of prenatal care and cesarean delivery rate. Of note, distance between a patient’s residence and the hospital differed by race, with African American women living significantly closer than Caucasian women, and a longer distance from the hospital was associated with a more frequent mortality. The authors suggest that “the next step toward understanding racial differences in maternal deaths reported in the United States should be directed at the health care delivery outside the tertiary care hospital setting, particularly at eliminating access barriers to health care for all women.”


This retrospective review evaluated maternal deaths between 2007 and 2012 among the 110 maternal/newborn facilities in 21 states that comprise the Hospital Corporation of America (HCA). This review is a follow-up to a similar maternal mortality review that occurred in the HCA system between 2000 and 2006 as a result of which three disease-specific protocols were introduced in all HCA hospitals: 1) the universal use of intra- and postoperative pneumatic compression devices in women who undergo cesarean delivery; 2) a specific checklist-based protocol to promptly recognize and treat hypertensive crisis and preeclampsia-related pulmonary edema; and 3) a checklist-based protocol directed at obtaining assistance and timely fluid and blood replacement in cases of postpartum hemorrhage. Between 2007 and 2012 there were 81 maternal deaths in 1,256,020 deliveries for a rate of 6.4 per 100,000 births. Between the 2000-2006 data and the 2007-2012 data, there was a significant decline in postcesarean pulmonary embolism (p = 0.038), and the rate of deaths from hypertensive diseases of pregnancy (p = 0.02). The rate of death as a result of hemorrhage did not decrease, and trended toward an increase (p = 0.07). The authors discuss the success of the protocols implemented regarding prevention of postcesarean pulmonary embolism and
preeclampsia, but admit that more needs to be done beyond the implementation of hemorrhage protocols to prevent maternal death from hemorrhage.


This most recent triennial report (2009-12) shows an overall decrease in the rate of maternal death across the UK (357 maternal mortalities), and for the first time includes Ireland’s data (203 maternal mortalities). Maternal death from genital tract sepsis fell, but death from different infections increased, attributable to the influenza A H1N1 pandemic (1 in 11 of all deaths). Rates of obstetric causes of maternal deaths continued to fall, with death from hypertensive disorders the lowest it’s been since 1952. However, maternal death from indirect causes continued to rise, with women with severe co-existing disease such as heart disease, epilepsy, cancer, diabetes and mental health disease vulnerable. The report emphasizes the importance of influenza immunization in pregnancy, multidisciplinary care for women with co-existing disease, watching for early obstetric warning signs with rapid escalation of care when indicated, the provision of obstetric critical care for deteriorating women, and the early suspicion of sepsis.


This study utilized delivery data from seven states through the State Inpatient Database to examine delivery hospitalizations from 2008-2010. The purpose of the study was to use population-level data to examine racial and ethnic disparities in severe maternal morbidity indicators during delivery hospitalization. Blood transfusion, as collected by ICD-9 codes, was the most common indicator of severe morbidity. Overall, severe maternal morbidity rates that were measured with and without blood transfusion were, respectively, 150.7 and 64.3 per 10,000 delivery hospitalizations. Race/ethnicity was found to be an important predictor of severe morbidity with non-Hispanic black women reported to have the highest rates of severe morbidity with blood transfusion compared to other racial groups.


These authors report the work of the Division of Reproductive Health at the Centers for Disease Control and Prevention on severe maternal morbidity and mortality in the US. This division of the CDC collects death certificates from all states of women who die during or within one year of pregnancy. Notably, the pregnancy-related mortality ratio has increased steadily from 7.2 deaths per 100,000 live births in 1987 (when they first started collecting data) to 17.8 deaths per 100,000 live births in 2009. Race differentials are striking. There have been changes to the way the data are collected which the authors state could account for the increasing numbers. However, the increase trends of severe maternal morbidity mirror the increases in maternal mortality. And, the authors postulate from other studies that an increasing number of women with chronic disease are getting pregnant. Notably, there was a disproportionately high rate of maternal deaths in 2009 due to the H1N1 influenzae A pandemic.

**The national partnership for maternal safety**


This commentary discusses the 2012 formation of the National Partnership for Maternal Safety which is a multi-stakeholder organization comprised from leaders across the spectrum of women’s health (including SOAP) with the goal of improving maternal health and safety in the United States. This organization has developed three core patient safety bundles—obstetric hemorrhage, severe hypertension in pregnancy and venous thromboembolism prevention in pregnancy. They have also created supplemental patient safety bundles which include maternal early warning criteria, case review packages for use in cases of severe maternal morbidity and mortality, and family and staff support for patients families and staff who experience a severe maternal event. The steering committee of the National Partnership for Maternal Safety and the Council on Patient Safety in Women’s Health Care believe the three core patient safety bundles should be implemented in every birthing facility in the United States within the next 3 years with the goal of reducing maternal death and morbidity by 50% in the next 5 years.

114. [http://www.safehealthcareforeverywoman.org](http://www.safehealthcareforeverywoman.org)

This is the website for the Council on Patient Safety in Women’s Health Care whose mission is to “continually improve patient safety in women’s health care through multidisciplinary collaboration that drives culture change.” The goal of the organization is to foster
investigation to better understand the causation of harm, to foster programs to implement patient safety initiatives, to educate to promote patient safety and to foster a health care culture of respect, transparency and accountability. The website introduces their National Improvement Challenge which seeks to improve maternal care through the development of patient safety and quality improvement programs at the residency and educational program level. It also offers resources such as free safety teleconferences, patient safety bundles (e.g. the “hemorrhage bundle”), as well as forms that can help institutions through the process of reviewing maternal morbidity events.


Reviewed under “Maternal early warning systems”

Severity of illness scores in pregnancy


Accompanied by editorial:

This retrospective study evaluated multiple mortality prediction scores on all obstetric patients admitted to the intensive care unit between 2006 and 2011 in a Columbia teaching hospital. Overall, 726 obstetric critical care patients were included. The Simplified Acute Physiology Score 2 and the Simplified Acute Physiology Score 3 overestimated mortality. The Mortality Probability Model III was inaccurately calibrated. The Mortality Probability Model II (MPM II) predicted mortality best with a mortality ratio of 0.88 (95% CI 0.60-1.25). This article is accompanied by an editorial which discusses the value of ICU scoring systems and the very good discrimination and calibration that the MPM II providing, suggesting that “this is a score against which new (critical care obstetric patients) should be compared.”

117. Bandeira AR, Rezende CA, Reis ZS, Barbosa AR, Peret FJ, Cabral AC: Epidemiologic profile, survival, and maternal prognosis factors among women at an obstetric intensive care unit. Internation journal of gynecology & obstetrics 2014; 124: 63-6

This prospective cohort study of women admitted to a Brazilian obstetric intensive care unit between 2007 and 2009, found that among 298 women admitted to the ICU, mortality was 4.7% (n=14). Hypertensive disorders (46%) hemorrhage (16%), sepsis (14%) and heart disease (5.7%) were the main causes of admission. Most of the survivors were admitted for direct obstetric causes (75.5%; p=0.044). Survival rates of patients admitted for indirect causes were lower than those admitted for direct obstetric causes (27.8 versus 19.6 days, respectively, p=0.019). The authors conclude that the patients that were admitted to their ICU with direct obstetric causes had a better prognosis.

Maternal early warning systems


This commentary reviews the evidence and considerations for implementation regarding the Obstetric Early Warning Criteria, a list of abnormal patient parameters that trigger urgent bedside evaluation by a clinician who can then potentially pursue diagnostic and therapeutic interventions. The authors discuss the various types of early warning systems (single parameter systems versus multi-parameter aggregate-weighted tools) and the sensitivity and specificity of the Modified Early Obstetric Warning system which was recommended in the 2003-2005 Saving Mother’s Lives report. In the United States, the National Partnership for Maternal Safety brought together a workgroup that defined this list of abnormal parameters which compromise the “Maternal Early Warning Criteria” which include HR <50 or >120, SBP <90 or >160; DBP >100; RR <10 or >30; Oxygen saturation on room air < 95%; UOP <35mL/hr for >2 hour; and various maternal symptoms such as agitation, confusion, unresponsiveness, shortness of breath or non-remitting headache. The authors of this commentary recommend randomized controlled trials to evaluate whether the Maternal Early Warning Criteria facilitates more timely diagnosis and treatment and thus limit the severity of obstetric morbidity.

These authors sent surveys through the Obstetric Anaesthetists’ Association in 2012 to all 205 lead obstetric anaesthetists in the United Kingdom regarding their use of an obstetric early warning system. An obstetric early warning system was recommended for use in the UK in the 2003-2005 Saving Mother’s Lives report and is considered an auditable maternal safety standard for the National Health System in the UK. These authors obtained a response rate of 63% (n = 130) and all (100%) respondents reported the use of an obstetric early warning system. This is in comparison to a similar survey performed in 2007 which indicated a 19% use. The respondents believed the most important parameters to record were respiratory rate, heart rate, temperature, systolic and diastolic blood pressure and oxygen saturation. Ninety one percent agreed that the use of the early warning system helped to prevent obstetric morbidity. Staffing pressures were felt to be the greatest barrier to the tool’s use.

Cardiac arrest


These guidelines were commissioned by the Board of Directors of SOAP with the goal of addressing the challenges of maternal cardiac arrest. It delves far deeper into the topic of maternal cardiac arrest than the 2010 American Heart Association guidelines. From recommendations regarding point-of-care checklists to operational strategies such as educational, communication, and periodic systems testing, this excellent consensus statement is a must-read for all directors of obstetric anesthesia practices. Of note, the authors recommend manual uterine displacement instead of a left lateral tilt.


This simulation study compared the effectiveness of chest compressions in a manikin in the supine position (simulating manual uterine displacement) versus left lateral tilt using a foam-rubber wedge both on the floor and in a hospital bed. The tilt of the manikin was confirmed with a digital angle meter smartphone applications, and the efficacy of the chest compressions were evaluated the Laerdal PC Skill Reporting software installed on the manikin. The effectiveness of the chest compressions were similar in the supine versus the lateral tilt positions on both the floor and the bed, but the participants rated the manikin as feeling more stable and rated the chest compressions easier to perform in the supine position.


Accompanied by editorial:

This retrospective review of the Nationwide Inpatient Sample evaluated 56,900,512 hospitalizations for deliveries between 1998 and 2011 and found that cardiac arrest occurred in 4,843 cases or 8.5 per 100,000 (99% CI, 7.7 to 9.3 per 100,000) hospitalizations. The most common causes of arrest were postpartum hemorrhage (n = 1349, 27.9%), antepartum hemorrhage (n = 813, 16.8%), heart failure (n = 645, 13.3%), amniotic fluid embolism (n = 645, 13.3%), sepsis (n = 544, 11.2%), anesthesia complications (n = 379, 7.8%), aspiration pneumonitis (n = 346, 7.1%), venous thromboembolism (n = 346, 7.1%), and eclampsia (n = 296, 6.1%). Overall, 59.0% (99% CI, 54.9 – 63.1%) of women who experienced cardiac arrest survived to hospital discharge. Survival was lowest for aortic dissection/rupture (14 women, 0 survived) and trauma (125 women, 29 [23.3%] survived), and highest for anaphylaxis (15 women, 15 [100%] survived), magnesium toxicity (66 women, 57 [85.9%] survived), aspiration pneumonitis (346 women, 287 [82.9%] survived), and anesthesia complications (379 women, 310 [81.9%] survived). Women who experienced cardiac arrest were more likely to be 35 years or older, black, and more likely to be funded by Medicaid. The medical conditions associated with cardiac arrest included pulmonary hypertension (aOR 13.3; 99% CI 6.0-39.6), malignancy (aOR 12.5; 99% CI 4.7-33.0), ischemic heart disease (aOR 7.6; 99% CI 2.1-27.5), liver disease (aOR 5.5; 99% CI 2.3-13.1) congenital heart disease (aOR 4.2; 99% CI 1.6-11.0), systemic lupus (aOR 4.1; 99% CI 1.8-9.8), and cardiac valvular disease (aOR 3.8; 99% CI 2.2-6.3). Overall, the frequency of arrest remained unchanged throughout the time period (p=0.017), but survival improved slightly. The editorial that accompanies this article discusses that this study reports the largest sample of maternal cardiac arrest in the published literature, and
the rate of 1 in 12,000 deliveries is much higher than previous estimates. Further, the editorial states that this rate underrepresents maternal cardiac arrest in total because arrests in the postpartum after hospital discharge were not included in this study.

Amniotic fluid embolism

Hamamatsu University School in Medicine maintains the Japan amniotic fluid embolism (AFE) registration center which began collecting a data base and specimen bank in 2003 of clinical data, maternal serum and uterine tissue of women with both fatal and nonfatal AFE as defined by The Japan Consensus Criteria for the Diagnosis of AFE. The school has collected such data and samples on nearly every fatal AFE that has occurred in Japan since 2003. They previously determined the amount of amniotic fluid complements in the serum of women with AFE, as well as that uterine atony in AFE cases seems to be associated with uterine angioedema. These authors suspected that C1 esterase inhibitor may contribute to the overall AFE syndrome because of its role in the coagulofibrinolytic system, complement system, kallikrein-kinin system and the fact that its deficiency causes both hereditary and acquired angioedema. Among 106 cases of AFE in the registry during the years 2010 and 2011, 85 were nonfatal and 21 fatal. The authors used serum samples obtained from 88 women who delivered without AFE as controls. C1 esterase inhibitor activity levels were lower in women with AFE (30.0% ± 1.8%) than in control women (62% ± 2.0%) (p<0.0001). C1 esterase inhibitor activity levels in fatal amniotic fluid embolism cases (22.5% ± 3.4%) were significantly lower than those in nonfatal amniotic fluid embolism cases (32.0% ± 2.1%) (p<0.05). The authors speculate on the potential clinical application of utilizing C1 esterase inhibitor levels to determine women at risk for AFE, as a prognostic indicator for those who have experienced AFE, as well as the use of C1 esterase inhibitor concentrates in the treatment of AFE.


This review by one of the world’s experts in amniotic fluid embolism (AFE) emphasizes the difficulty in diagnosing AFE; the likely involvement of trophoblastic tissue antigens producing thromboplastin-like effects resulting the observed coagulopathy; similar endogenous pro-inflammatory mediators and pro-coagulant activation as is observed in anaphylaxis, SIRS, and septic shock; variable clinical expression of the syndrome; the possibility that the stimulus may involve either fetal or infectious stimuli from the uterus; the fact that the diagnosis involves the triad of hypotension, hypoxia and coagulopathy with the exclusion of other conditions; and the fact that any biochemical indices for diagnosis are still investigational. He goes on to emphasize the importance of emergent delivery, lateral displacement of the uterus during CPR prior to delivery, preparation for transfusion prior to laboratory confirmation of coagulopathy, and crystalloid fluid management during the event recognizing that acute lung injury and pulmonary edema will likely follow in surviving patients.

Aortic dissection

These authors reviewed the PubMed database to identify publications related to pregnant women with acute aortic dissections during the period 2003-2013. Fifty nine articles and 75 patients were included in the analyses. Stanford type A accounted for 77% of all cases. The majority of cases (78%) occurred in the third trimester and immediate postpartum period. Inherited connective tissue disorders were causative in 49% of patients. Maternal mortality was not statistical different between type A and type B dissections (21% vs. 23%), but fetal outcomes were worse in type B dissections (35% vs. 10.3%; P<0.05). Fetal mortality in type A dissections was dependent on the timing of aortic repair, with antepartum aortic repair associated with a higher mortality (36%). Patients undergoing combined cesarean section with aortic repair had favorable fetal outcomes.

Pulmonary embolism

This retrospective study used insurance claims data from emergency departments and acute care hospitals in California between 2005 and 2010 to determine the rate of ischemic stroke, acute myocardial infarction or venous thromboembolism in postpartum women in comparison to the following year when they are not postpartum. There were 1,687,930 women with first deliveries and 1015 had a thrombotic event (248 cases of stroke, 47 cases of myocardial infarction, and 720 cases of venous thromboembolism). The risk of primary thrombotic events was markedly higher within 6 weeks after delivery than in the same period 1 year later, with 411 events versus 38 events, for an absolute risk difference of 22.1 events (95% CI 19.6 - 24.6) per 100,000 deliveries and an odds ratio of 10.8 (95% CI, 7.8 to 15.1). The elevated risk of thrombosis was lesser from 6 to 12 weeks than 0 to 6 weeks, but was still greater than the following year’s risk. The risk of thrombotic event was not increased after the first 12 weeks after delivery.
Sepsis


This systematic review worked to establish and compare the normal maternal range for each component of the systemic inflammatory response syndrome (SIRS) criteria and then compare normal maternal parameters to SIRS criteria. The authors narrowed their extensive literature search to 87 articles including 8,834 parturients and 15,237 observations of healthy parturients overall. The authors found that overlap with the SIRS criteria occurred in healthy pregnant women during the second trimester, third trimester, and labor for every criteria (RR, PaCO₂, HR, and WBC count) except temperature. The authors conclude that current SIRS criteria are inadequate for women in pregnancy and postpartum and “novel criteria will likely be required to facilitate early diagnosis and prevent pregnancy-associated sepsis-related death.”


These authors designed a novel model to score potential sepsis severity and then retrospectively applied it to a cohort of pregnant and postpartum women who presented to an emergency department between 2009 and 2011 with a clinical suspicion of sepsis. Various vital signs and laboratory values were given a zero score when in the normal range and anywhere between 1 and 4 points depending on the degree of variance from normal. The primary outcome for the authors was admission to the intensive care unit. There were 850 women included with 9 (1.1%) ICU admissions, 32 (3.8%) telemetry admissions, and no maternal deaths. A score of ≥6 had a sensitivity of 88.9% and a specificity of 95.2%, a positive predictive value of 16.7% and a negative predictive value of 99.9% for ICU admission. A score of ≥6 was also independently associated with increased ICU or telemetry unit admissions, positive blood cultures, and fetal tachycardia. The authors recommend prospective validation.


This review article focuses on what the obstetric anesthesiologist can do to optimize maternal and fetal outcomes in maternal sepsis. The authors discuss how both maternal and fetal management strategies are typically complementary, but occasionally added maternal physiologic optimization may be necessary for fetal benefit. The concepts that the authors discuss include maximizing uteroplacental blood flow, minimizing fetal oxygen demand, early and appropriate intrapartum antibiotic administration, avoiding preterm delivery when possible, identifying a compromised fetus, and maintaining communication among obstetric team members. The authors recommend fetal monitoring for gestations beyond 24 weeks, and discuss areas of controversy that require further clinical trials including specific vasopressor choice, fluid management, and appropriate hemodynamic monitoring in maternal sepsis.


This retrospective study identified 58 cases of maternal bacteremia among 37,584 obstetric patients who presented at the Coomb Women and Infants University Hospital, Dublin, Ireland. Of the 58 cases, bacteremia was diagnosed in 19 women prepartum, in 20 women intrapartum, and in 19 women postpartum. No women died, two women developed septic shock, 4 women experienced early pregnancy loss, and 2 women experienced stillbirth. Escherichia coli was the most common organism in prepartum and postpartum bacteremia (n = 14 prepartum, n = 0 intrapartum, n = 10 postpartum), and beta-hemolytic, Lancefield Group B Streptococcus agalactiae was the most common intrapartum bacteremia (n = 0 prepartum, n = 10 intrapartum, n = 5 postpartum). Other organisms included Enterococcus faecalis (n = 4), Staphylococcus aureus (n = 2), Streptococcus pyogenes (n = 2), Klebsiella pneumonia (n = 2), and Haemophilus influenza (n = 2). There were no multi-drug resistant organisms.


This prospective case-control study utilized the United Kingdom Obstetric Surveillance System to estimate the incidence of, the causative organisms in, the sources of infection of, and the risk factors for maternal sepsis in the United Kingdom. Overall, 365 confirmed cases of severe maternal sepsis were collected between June 2011 and May 2012 out of 780,537 maternities for an incidence of severe sepsis of 4.7 (95% CI 4.2 - 5.2) per 10,000 maternities. Seventy-one (19.5%) women developed septic shock, and 5 (1.4%) women died. Causative organisms were identified in 233 (63.8%) cases with a source of the organism in 270 (74.0%) cases. The most common organism identified in the antepartum was E.coli (n=33, 24.6%) and Group B streptococcus (n=13, 9.7%), and in the postpartum were E.coli (n=44, 19.1%).
Group A streptococcus (n=30, 13.0%), staphylococcus (n=21, 9.1%) and Group B streptococcus (n=17, 7.4%). Overall, the most common source of infection was the genitourinary tract (31.0%). Readmission was more common in women diagnosed in the postpartum (n = 108, 48%) versus antepartum (n = 6, 5.0%). Risk factors for severe sepsis included black or minority ethnicity (adjusted OR 1.82, 95% CI 1.32-2.51); nulliparity (adjusted OR 1.17, 95% CI 1.17-2.20), a preexisting medical problem (adjusted OR 1.4, 95% CI 1.01-1.94), and a febrile illness or the use of antibiotics in the 2 weeks prior to presentation (adjusted OR 12.07, 8.11-17.97). Infection with Group A streptococcus (adjusted OR 4.84, 2.17-10.78) and multiple gestations (adjusted OR 5.75, 95% CI 1.54 – 21.45) were risk factors for progressing to septic shock. It was noted that Group A streptococcus progressed extremely rapidly from the first sign of SIRS to septic shock—in 50% of women in less than two hours and for 75% of women in less than 9 hours.

**Postpartum Hemorrhage Epidemiology**


This retrospective review of maternal blood transfusions in New South Wales, Australia identified 12,147 women that received transfusions across 891,914 deliveries to 578,207 women between 2001 and 2010 for a transfusion rate of 1.4%. The rate of obstetric blood transfusion steadily increased by 33% throughout the study period from 1.2% in 2001 to 1.6% in 2010 (p<0.001). Transfusion rate was high amongst women having a hysterectomy during their birth admission (n=439 [896 per 1000 deliveries]). Forceps delivery carried the greatest risk of transfusion (RR 2.8, 99% CI 2.51-3.04), followed by intrapartum cesarean delivery, vacuum delivery, and prelabor cesarean delivery. Women with placenta previa and bleeding (RR 4.6, 99%CI 3.44-6.26) or platelet disorders (vaginal delivery RR 7.8, 99% CI 6.93-8.73; cesarean delivery RR 8.7, 99% CI 7.69-9.76) also carried significantly greater risk of requiring blood transfusion.


These authors used the Premier Research Database to identify patterns of second-line uterotonic use among 367 hospitals for the treatment of uterine atony between 2007 and 2011 with the goal of determining if different hospitals utilize second line uterotonic agents at different frequencies not explained by risk factors for uterine atony. The cohort included 2,180,916 patients with an overall frequency of second-line uterotonic use of 7.1% with methergonovine 5.2%, carboprost 1.0% and misoprostol 1.2%. The authors observed wide interhospital variation which was not explained by patient-level or hospital-level characteristics. In their model adjusted for demographics, year of delivery, method/mode of delivery, medical/obstetrical conditions and hospital characteristics, 95% of hospitals had a predicted probability of utilizing second-line uterotonic agents between 1.69% (+0.12%) and 24.96% (+1.28%) suggesting that the frequency of use may largely be based upon nonmedical and institution-specific factors such as physician preferences, drug cost or availability, and local hospital culture.


This study evaluated the effect of familial clustering on postpartum hemorrhage (>1000mL blood loss) in the Swedish Medical Birth Register. Overall, 4.6% of vaginal deliveries were complicated by a postpartum hemorrhage. Among vaginal deliveries, 18% (95% CI 9% - 26%) of the variation in postpartum haemorrhage liability was attributed to maternal genetic factors, 10% (95% CI 1% - 19%) to unique maternal environment, and 11% (95% CI 0% - 26%) to fetal genetic effects. The authors conclude that “adjustment for known risk factors only partially explained estimates of familial clustering, suggesting that the observed shared genetic and environmental effects operate in part through pathways independent of known risk factors.”


This study evaluated the effects of postpartum hemorrhage history on the severity and the type of postpartum hemorrhage in subsequent pregnancies among 538,332 women in the Swedish Medical Birth Registry between 1997 and 2009. Women with a history of PPH had a 3-fold increased risk of PPH in their second pregnancy compared with unaffected women (15.0% vs 5.0%). Adjustment for stable maternal risk factors did not attenuate this risk significantly (adjusted RR 3.0; 95% CI 2.9-3.1). In a third pregnancy, the risk of PPH was 26.6% after 2 previously affected pregnancies, compared with 4.4% in women with no previous PPH. A history of a specific type of PPH (atony, retained placenta, or laceration) predicted recurrence of PPH in the second pregnancy, not only of the same type but other causes too. The authors conclude that “the recurrence patterns across PPH subtypes may point to shared pathologic mechanisms underlying the varying PPH causes.”

This retrospective study sought to find risk factors for uterine atony through a secondary analysis of data collected between 1999 and 2002 as part of the Cesarean Registry, an observational study conducted by the Eunice Kennedy Shriver National Institute of Health and Development Maternal-Fetal Medicine Units Network. Uterine atony was defined by a clinical note in the chart and administration of a second-line uterotonic agent. Hemorrhage related morbidity was defined by the presence of red cell transfusion, cesarean hysterectomy, uterine artery ligation, hypogastric artery ligation or ICU admission for pulmonary edema, coagulopathy, ARDS, postoperative ventilation, or the need for invasive monitoring. Overall, 57,182 women underwent cesarean delivery and 2,294 (4%) experienced uterine atony with 5 maternal deaths. In two different multivariate models, African-American race, Hispanic ethnicity, multiple gestation, placenta previa, ASA class III or IV, general anesthesia, and two or more prior cesarean deliveries were associated with the risk of hemorrhage-related morbidity.


This prospective observational study sought to determine the incidence and risk factors for postpartum hemorrhage (PPH) and the progression to severe postpartum hemorrhage in two United Kingdom maternity units. Two researchers reviewed all clinical data including lab reports, transfusion records and clinical notes to determine estimated blood loss and the accuracy of the estimated blood loss documented at the time. Overall 10,213 women delivered between 2008 and 2009 and 9937 were included in the study. Overall 33.7% of patients had a PPH > 500, 3.9% > 1500, and 0.82% > 2500. Risk factors for PPH included Black African ethnicity (aOR 1.77, 95% CI 1.31-2.39), assisted conception (aOR, 2.93, 95% CI 1.30-6.59), elective cesarean delivery (aOR 24.4, 95% CI 5.53-108.00), emergency cesarean delivery (aOR 40.5, 95% CI 16.30-101.00), and retained placenta (aOR 21.3, 95% CI 8.31-54.7).


This Anesthesia Closed Claims Project involved 3,211 closed surgical or obstetric anesthesia malpractice claims from 1995-2011. Overall, 14% (41%) claims involved hemorrhage. Obstetric anesthesia overrepresented hemorrhage claims accounting for 30% of hemorrhage claims compared to 13% of non-hemorrhage claims (p<0.001). Mortality was higher in hemorrhage claims versus non hemorrhage claims (77 vs 27%, P<0.001), anesthesia care was more often to be judged less than appropriate (55 versus 38%, p < 0.001), and median payments were higher ($607,750 versus $276,000, p<0.001). Among the 43 OB hemorrhage cases, 13 (30%) had placenta accreta, 10 (23%) had retained placenta, 7 (16%) had uterine atony, 5 (12%) had amniotic fluid embolism, 4 (9%) had uterine rupture, 3 (7%) had placenta abruption, 3 (7%) had placenta previa, and 3 (7%) had intrauterine fetal demise. Common among many of the cases was a lack of timely diagnosis of hemorrhage.

Prevention and treatment of postpartum hemorrhage


This systematic review and meta-analysis involved 7 trials (n=1760) comparing prophylactic tranexamic acid and placebo for the prevention of postpartum hemorrhage in low risk women undergoing vaginal delivery (1 trial) or cesarean delivery under spinal anesthesia (6 trials). Doses in the studies were either 1 gram, 10 mg/kg, or 15 mg/kg. The risk ratio for blood transfusions was reduced after tranexamic acid administration (RR 0.34, 95% CI 0.20-0.60) when all 7 trials were included, but when the 2 trials with unusually high rates of transfusion in both control and treatment groups were eliminated, the risk ratio was no longer significant (RR 0.35, 95% CI 0.12 - 1.04, p=0.06). There was a reduction in blood loss in the tranexamic group versus the placebo group as well, (WMD -140.29mL, 95% CI -189.64-90.93mL; p < 0.00001) but heterogeneity was significant. Only four cases of thrombosis occurred, 2 in the tranexamic group, and 2 in the control group.


This non-blinded study randomized women (n = 521)between 2004 and 2011 who had experienced a postpartum hemorrhage, were now 12 to 24 hours after birth and were clinically stable with a hemoglobin of 4.8-7.9g/dL, to either an intervention arm (RBC transfusion to a goal Hgb of 8.9) or nonintervention arm (RBC transfusion only if severe symptoms of anemia developed). The study was designed and powered in a non-inferiority design with the primary outcome of physical fatigue at 3 days postpartum measured with the Multidimensional Fatigue Inventory (scale 4-20, higher score indicating more fatigue). Starting hemoglobin between the groups was
similar, women randomized to the intervention arm received a mean of 2 units (interquartile range 2-2) and were discharged with a mean hemoglobin of 9.0g/dl (interquartile range 8.5-9.5), and in the non-intervention arm was 0 units (interquartile range 0-0) and were discharged with a mean hemoglobin of 7.4g/dl (interquartile range 6.8-7.7). Mean physical fatigue score at day 3 was 0.8 (95% CI 0.1-1.8, p = 0.02) lower in the intervention arm. Because the study was designed with a non-inferiority boundary of a 1.3 maximal difference in fatigue score, and the confidence interval of the difference between fatigue scores crossed 1.3, non-inferiority could not be demonstrated. However, because the physical fatigue difference was so small and there was no difference in secondary outcomes (breastfeeding, infectious complications, thromboembolic events etc.), the authors conclude that “implementation of restrictive management seems clinically justified” in stable patients with hemoglobins between 4.8 and 7.9 at 12 to 24 hours after delivery.


This review article discusses the most recent evidence on the postpartum hemorrhage assessment and subsequent pharmacologic and transfusion therapy. The authors present the evidence of low fibrinogen as a predictor of severe postpartum hemorrhage and the application of early fibrinogen testing or, more rapidly, thromboelastometry in postpartum hemorrhage. They discuss the avoidance of hydroxyethyl starch in obstetric hemostasis as well as the trauma literature regarding RBC to FFP transfusion ratios and how this may, or may not translate to hemorrhaging obstetric patients. The authors discuss the unanimous agreement from professional societies regarding multidisciplinary obstetric hemorrhage protocols. The authors call for randomized controlled trials to validate the efficacy and safety of antifibrinolytic therapy as well as fibrinogen concentrates. They discuss the ongoing, randomized, placebo-controlled trial enrolling 20,000 patients to investigate the endpoint of tranexamic acid on maternal death or hysterectomy.


This article presents a postpartum hemorrhage algorithm that was developed by obstetricians, anesthesiologists and hematologists from Austria, Germany and Switzerland. The algorithm is divided into 4 steps progressing from moderate vaginal bleeding to persistent bleeding with hemodynamic instability and outlines the escalation of personnel, uterotonics, drugs, transfusion, and pharmacologic therapies as well as criteria for transfer from one institution to another with greater resources.


These authors assess cell salvage from an economic perspective. They developed a decision model and compared two cesarean delivery strategies—the setup of intraoperative cell salvage for routine cesarean delivery versus standard care without cell salvage for cesarean delivery. The authors estimated that if 3.2% of women undergoing cesarean delivery required a blood transfusion then cell salvage would only be cost saving if each of these women required at least 60 units. If two units are needed per cesarean delivery then at least 58% of patients would need to require transfusion to make routine use of cell salvage cost-saving. Because in cases of severe anemia or in abnormal placentaion, the likelihood of transfusion for these patients could be this high, the authors argue that in those scenarios, cell salvage could be cost-saving. Otherwise, according to their calculations, the routine setup of intraoperative cell salvage would increase the cost per cesarean delivery by $223.80.


These authors surveyed directors of United States academic obstetric anesthesia units regarding whether their units had a postpartum hemorrhage protocol as recommended by the National Partnership for Maternal Safety. They had a 58% response rate and 67% of the responding units had a postpartum hemorrhage protocol. Larger units were more likely to have a protocol in comparison to smaller units—the median annual delivery volume for responding units with a PPH protocol was 3900 while that for units without a PPH protocol was 2300. Therefore, the authors recommend that national efforts to ensure universal presence of PPH protocols should focus on small-volume facilities to achieve the greatest impact.


This study describes the comparison of contractile responses of myometrium excised from the uteri of 46 laboring and non-laboring women undergoing cesarean delivery under spinal anesthesia. The myometrial strips were exposed in vitro to one of four uterotonic agents—oxytocin, ergonovine, prostaglandin F2 alpha and misoprostol. The motility index (MI = amplitude x frequency of tissue contraction) was greatest overall for oxytocin (mean 5.1, 95% CI 4.7-5.5) than for ergonovine (mean 3.46, 95% CI 3.13-3.80, p<0.001), PGF2alpha (2.64, 95%

This multicenter trial sought to obtain reference ranges for rotational thromboelastometry during the peripartum period by taking blood samples from 161 women in labor and within one hour of delivery. The results were comparable between centers and between the two times the samples were taken from women allowing for the establishment of reference values.


This retrospective case-control study compared 50 women who experienced massive postpartum hemorrhage (>30% loss of blood volume) with 50 controls in order to determine an "obstetric shock index" at 10 and 30 minutes from the onset of the hemorrhage. A "shock index" is defined as a patient’s heart rate divided by the systolic blood pressure and has previously been described to assess hypovolemic shock in trauma and non-trauma blood loss. A normal shock index range for a healthy nonpregnant person not losing blood is 0.5-0.7. Both cesarean and vaginal deliveries were included. The mean Obstetric Shock Index in the case group at 10 minutes was 0.91 ± 0.42 (range 0.4-1.5) and at 30 minutes was 0.90 ± 0.33 (range 0.5-1.4). The mean Obstetric Shock Index in the control group was 0.74 ± 0.30 (range 0.4-1.1) at 10 minutes and 0.76 ± 0.27 (range 0.5-1.1) at 30 minutes. The authors recommend that a normal Obstetric Shock Index after birth be 0.7-0.9, and an OSI greater than 1 could be useful in estimating the need for blood products.


This retrospective study evaluated women who had a fibrinogen level tested in the 21 days prior to delivery and looked for a correlation between this and the estimated blood loss at delivery. Postpartum hemorrhage was defined as an estimated blood loss >700mL for vaginal delivery, and > 1000mL for cesarean delivery. The authors found that for vaginal delivery (n=337), antenatal blood loss tended to increase with decreasing antenatal fibrinogen concentrations (R=-0.107, p= 0.05); median fibrinogen concentration was lower in the 69 women with postpartum hemorrhage than in the 268 women without postpartum hemorrhage (3.93 vs. 4.18 g/L, p = 0.025); and postpartum hemorrhage occurred significantly more often in women with fibrinogen concentrations <3.3g/L compared to those with concentrations ≥3.3g/L (38%/11/29) vs 19% [58/306]. P = 0.018. The correlations, however, did not hold true for women under undergoing cesarean delivery (n = 534).


These authors created an obstetric in vitro hemodilution model to investigate the 1:1:1 ratio as recommended in trauma hemorrhage. Blood from 20 parturients at term was diluted 50% with 0.9% normal saline and was reconstituted with 1:1 PRBC:FFP or 3:1 PRBC:FFP. In 10 samples, platelets were also added. Maximum amplitude was lower compared to baseline values in both groups after 50% dilution with normal saline (P < .001) and remained lower than baseline despite reconstitution with 3:1:0 or 1:1:0 PRBC:FFP:PLT (P < .0001) or 3:1:1 PRBC:FFP:PLT (P < .01). Maximum amplitude approached baseline in the samples with 1:1:1 PRBC:FFP:PLT.


These authors compared thrombelastography and laboratory analysis in the management of 45 obstetric patients experiencing major hemorrhage and 49 women with a blood loss greater than 600mL. They found the strongest correlations between fibrinogen and TEG-MA; and between estimated blood loss and TEG-MA, fibrinogen and antithrombin, respectively. Overall, thromboelastography provided faster results than standard laboratory testing. However, laboratory analyses found greater differences in coagulation variables, which correlated better with estimated blood loss.
Placenta Accreta


This prospective observational study reports an Italian hospital’s experience managing 53 cases of placenta accreta/increta/percreta. From 2004 through 2009, 23 cases were managed with cesarean hysterectomy alone and from 2009 through 2013, 30 cases were managed with cesarean hysterectomy and intravascular balloon catheters in the internal iliac arteries. Placenta accreta/increta/percreta was confirmed via pathology of the removed uterus. There were no complications with the endovascular balloons. All women in the study were managed with an epidural anesthetic which was converted to a general anesthetic in the event of severe bleeding. Overall, a difference was found between the estimated blood loss and the amount of transfused blood products between the hysterectomy only group (EBL 1156 ±576.69mL; 1.96 units + 2.46 units) versus the balloon catheter group (EBL 846.67mL ± 280.06mL; 0.47 units + 0.86 units) (p=0.036 for EBL and p=0.011 for blood products transfused). Interestingly, though, when those with placenta accreta/increta and those with placenta percreta cases were analyzed separately, no differences in EBL or transfusions were found in those with placenta accreta/increta, but significant differences were found in both EBL and blood products transfused in those with placenta percreta. The authors conclude that the use of balloon catheters is safe, and that they should be used when prenatal diagnosis does not allow for differentiation between placenta accreta and percreta, and in cases where the woman wishes to attempt to keep her uterus to preserve her fertility. The authors also conclude that balloon catheters may not provide benefit in placenta accreta without percreta which is proceeding directly to hysterectomy.

Maternal mortality in developing countries


These authors utilized the WHO mortality database as well as searched for articles published between 2003 and 2012 to gather data on maternal mortality. They identified 23 eligible studies and included 417 datasets from 115 countries comprising 60,799 deaths. About 73% (1 771 000 of 2 443 000) of all maternal deaths between 2003 and 2009 were due to direct obstetric causes and 27.5% (672 000, 95% UI 19.7-37.5) were from indirect causes. Haemorrhage accounted for 27.1% (661 000, 19.9-36.2), hypertensive disorders 14.0% (343 000, 11.1-17.4), and sepsis 10.7% (261 000, 5.9-18.6) of maternal deaths. The rest of the deaths were due to abortion (7.9% [193 000], 4.7-13.2), embolism (3.2% [78 000], 1.8-5.5), and all other direct causes of death (9.6% [235 000], 6.5-14.3). Regional estimates varied substantially.

153. Lawn JE, Blencowe H, Oza S, et. al. Every Newborn: progress, priorities, and potential beyond survival. Lancet 2014; 384: 189-205

and


These article published in the Lancet focus on how newborn deaths and stillbirths have been overlooked in the past in global health efforts. They discuss the worldwide trends since the 2005 Lancet Series on Neonatal Survival and proposes targets for 2035 of no more than 10 stillbirths per 1000 total births, and no more than 10 neonatal deaths per 1000 livebirths. The excellent review reminds us that the 2.9 million annual neonatal deaths worldwide are attributable to three main causes: infections (0.6 million), intrapartum conditions (0.7 million), and preterm birth complications (1.0 million). They also state that “failure to improve birth outcomes by 2035 will result in an estimated 116 million deaths, 99 million survivors with disability or lost development potential, and millions of adults at increased risk of non-communicable diseases after low birthweight.”


This article funded by the Bill and Melinda Gates Foundation is an update on the Millennium Development Goal which established the goal of a 75% reduction in the worldwide maternal mortality ratio between 1990 and 2015. The authors aimed to measure mortalities and track trends using a database of data that encompassed 7065 site-years among 188 countries between 1990 and 2013. Overall, 292,982 maternal deaths occurred in 2013, compared with 376,034 in 1990. The global annual rate of change in the maternal mortality ratio was -0.3% (-1.1 to 0.6) from 1990 to 2003, and -2.7% (-3.9 to -1.5) from 2003 to 2013 suggesting an acceleration of progress. Causes of death varied by region and year. In 2013, most maternal deaths occurred intrapartum or postpartum. The authors found substantial variation in the
maternal mortality ratio by country in 2013, from 956.8 (685.1-1262.8) in South Sudan to 2.4 (1.6-3.6) in Iceland. The authors state that their data suggests that only 16 countries will achieve the Millennium Development Goal target by 2015.


With the end of 2014 marking the end of the WHO Millennium Development Goal of reducing maternal mortality ratio by three quarters, the BJOG journal published special issues focusing on international maternal and neonatal mortality. Commentaries include maternal mortality reduction through evidence-based clinical guideline adherence, conducting near-miss audits, and the cultural environment necessary to conduct successful maternal morbidity audits and reviews. Neonatal morbidity and mortality is also addressed. Multiple authors describe experiences with maternal death reviews and collecting obstetric quality data from the United Kingdom, India, Indonesia, Myanmar, Nepal and Sri Lanka, as well as the countries of Cameroon, Nigeria, Malawi, Ghana, and Moldova. These articles drive home that nearly all deaths in developing regions would be preventable in the developed world. For example, a study following four districts of Bangladesh showed that 78.8% (450 out of 571 maternal deaths in a 2 year period) occurred in the first 6 hours after giving birth with the most likely cause hemorrhage. Audits showed improvements of quality of care in Niger and Mali (who were focusing on the postpartum period and hemorrhage reduction/treatment) which, in turn, markedly improved maternal mortality rates. Further commentaries include lessons learned while reducing maternal mortality in Central Asia, Europe and Malaysia. This issue also contains descriptions of the confidential enquiry into maternal deaths in South Africa and Kerala, as well as a series of excellent articles on stillbirth and neonatal death reduction. The opening editorial on supplement 4 reminds us that in 2014, there is still an estimated 289,000 maternal mortalities per year worldwide, with 2.6 million babies stillborn, and 3 million babies dying within one month of birth. This issues serve as primers for those interested in one of the world’s most pressing needs—reduction of worldwide maternal and neonatal mortality.

1 Heiby JR, Armbuster D, Jacobs TA. Better care for every patient, every time: improving quality in low health systems. British journal of obstetrics & gynaecology 2014; 121 Suppl 4: 4-7
3 Lewis G: The cultural environment behind successful maternal death and morbidity reviews. British journal of obstetrics & gynaecology 2014; 121 Suppl 4: 24-31

156. International Journal of Gynecology and Obstetrics 2014; 126 Supplement #1

The July 2014 supplement to the International Journal of Gynecology and Obstetrics reports on the International Federation of Gynecology and Obstetrics (FIGO) effort to reduce maternal morbidity and mortality associated with unsafe abortion. Various authors cite the prior 2008 WHO report of 21.6 million unsafe abortions occurring worldwide per year with some areas attributing 13% of their maternal mortalities to death from sepsis or hemorrhage because of the practice. FIGO’s international efforts described in this issue “range from preventing an unintended/unwanted pregnancy to preventing an inevitable abortion from being unsafe; preventing further complications resulting from an unsafe abortion that has already been performed; and preventing repeat abortion through postabortion counseling and by immediately providing a contraceptive method of the woman’s choice.” In this supplement, articles are split into regions describing FIGO’s efforts in South America, Central America and the Caribbean, East, Central and Southern Africa, West and Central Africa, and South-Southeast Asia. The manual vacuum aspiration and its use in incomplete abortion in Honduras, Cameroon, Bangladesh, and Pakistan is described. FIGO’s initiative in postabortion contraception in general and specifically in Gabon, Zambia, Bangladesh, and Pakistan are discussed.
Postdural puncture headache and epidural blood patch

158. Pratt SD, Kaczka DW, Hess PE: Observational study of changes in epidural pressure and elastance during epidural blood patch in obstetric patients. International journal of obstetric anesthesia 2014; 23: 144-50

This prospective observational study found a curvilinear relationship between the volume of blood injected during an epidural blood patch and the pressure generated in the epidural space. Eighteen EBPs were performed in 17 patients in the left lateral decubitus position. After LOR, a three-way stopcock was placed at the end of the 17-gauge Tuohy needle. One port of the stopcock was connected to a strain-gauge
pressure transducer using sterile non-compressible tubing. Initial pressure in the epidural space for each patient was defined as the zero point prior to injection of blood. Static epidural pressure was measured after each 5 mL injection of blood with until the patient experienced mild back pressure or discomfort. After EBP completion, the patient was asked to sit and the initial efficacy of the injection was categorized as “complete”, “partial”, or “no improvement.” Mean (SD) blood volume injected was 18.9 (+/- 7.8) mL with a range of 6-38 mL. Mean (SD) final pressure was 13.1 (+/- 13.4) mmHg with a range of 2-56 mmHg. Fifteen out of eighteen (83.3%) patients had “complete” or “partial” initial success. There was a strong correlation between the volume injected and the pressure generated. This could be expressed by both a quadratic (+0.0254 x (mL injected)^2 +0.0297 mL) or power (+0.0679 x mL injected)^1.42 relationship, each with fair correlation (r^2=0.57). There was no correlation between the final pressure generated and the success of the epidural blood patch, however the sample size was small. The authors point out that much of the procedure was not standardized, such as the rate of injection of blood and the time at which steady state epidural pressure was determined.


Accompanied by editorial:

This study randomized patients experiencing an accidental dural puncture (ADP) to prophylactic epidural blood patch (EBP) versus therapeutic (traditional management) EBP. Patients experiencing an ADP had an epidural catheter re-sited. They were then randomized to prophylactic vs. therapeutic EBP groups. In the prophylactic group, 15-20 mL of autologous was given through the indwelling epidural catheter at least 5 hours after the last dose of epidural local anesthetic. Subjects in the therapeutic EBP group were initially treated with conservative management and then offered EBP if postdural puncture headache (PDPH) developed. Sham EBPs were not used. An independent blinded observer evaluated all patients at 12-hour intervals while in hospital and daily for one week after discharge. In contrast to other studies (most notably Scavone and Wong in 2004), the authors found a significant decrease in the frequency of headaches in patients receiving a prophylactic EBP (18.3% vs. 79.6%, p < 0.0001). Only 10% of patients in the prophylactic EBP group received a second EBP. There was no significant difference in onset time to PDPH between groups. In patients who did develop a headache, there did not appear to be differences in headache severity. No adverse effects or events were reported.


This retrospective study compared the effects of placing an intrathecal catheter versus re-siting an epidural catheter after accidental dural puncture (ADP) on the development of postdural puncture headache (PDPH). For the first six years of the study period, re-siting an epidural was performed following an accidental dural puncture (n=39) while in the most recent 10 years, an intrathecal catheter was placed (n=89). After delivery, the intrathecal catheter was kept in situ for a minimum of 24 hours with 0.9% NaCl running at 2 mL/hr. Prolonged intrathecal catheter placement reduced the risk of PDPH after ADP to 42% compared with 62% in patients who had the epidural re-sited (OR 2.3, 95% CI 1.04-4.86). The need for EBP was not statistically different between groups (36% vs. 54%, p=0.06), but fewer patients in the intrathecal catheter group needed a 2nd EBP. Although the 16 year study period was lengthy, and small unconscious practice differences between the two epochs could have occurred that influenced results, 18 gauge epidural needles were used for the entire study period and departmental policies remained consistent over the study period.


This retrospective study evaluated 125 accidental dural punctures/post-dural puncture headaches over a six-year period (the 125 include witnessed wet taps, intrathecal catheters, or PDPH criteria being met after difficult epidural insertion). Women were classified into “non-obese” (<30 BMI) and “obese” (>30 BMI) groups. Contrary to previous studies, this study found no difference in the incidence of PDPH following accidental dural puncture between obese and non-obese women (82% vs. 80%, p=0.827). Additionally there was no statistical difference between BMI groups with regards to PDPH intensity, EBP performance (57% vs. 54%, p=0.806), or EBP success (full relief 57% vs. 65%, p=0.783).


These authors analyzed a series of 27,064 patients who had neuraxial procedures between 2001 and 2010 and found 142 post-dural puncture headaches. Eight (5.6%, 95% CI 1.7-9.4%) presented with an atypical non-postural headache. Associated symptoms were stiffness and pain in the cervical, thoracic or lumbar vertebral area, visual disturbances and vertigo. Risk factors for developing a nonpostural
postdural puncture headache included previous migraine, odds ratio 6.1 (95% CI 1.2–28.7), a more cephalad level of needle insertion, (OR 17.2, 95% CI 1.4–210.1) and identification of dural puncture by aspiration of cerebrospinal fluid from the epidural catheter, (OR 5.5, 95% CI 1.2–24.4). In multivariate analysis, recognition of dural puncture by flow of cerebrospinal fluid from the epidural catheter was the most significant predictor of non-orthostatic postdural puncture headache.

Non-obstetric surgery during pregnancy

This population-based matched cohort study utilized data from the Healthcare Cost and Utilization Project, Nationwide Inpatient Sample between 2003 and 2010 and found that among 7,037,386 births, 7,114 women developed appendicitis for an incidence of 101.1 cases per 100,000 births. They found that peritonitis (aOR 1.3), sepsis (aOR 1.9), transfusion (aOR1.7), pneumonia (aOR 2.5), bowel obstruction (aOR 1.9) postoperative infection (aOR2.0), and length of stay >3 days (aOR2.3) were all more likely in pregnant women compared to nonpregnant women. Women who were pregnant were more likely to be managed conservatively compared to those who were not pregnant. Pregnant women who were managed conservatively were at increased risk of sepsis (aOR 2.6), septic shock (aOR 6.3), peritonitis (aOR 1.6), and venous thromboembolism (aOR 2.5) compared to pregnant women with appendicitis who underwent surgical management.

Prenatal care and assessment

Accompanied by editorial:
Yurkiewicz IR, Korf BR, Lehmann LS. Prenatal whole-genome sequencing--is the quest to know a fetus's future ethical? The New England journal of medicine 2014; 370: 195-7

This series collected blood from 1914 general obstetric patients (i.e. not high risk) who were undergoing standard aneuploidy screening (which included biochemical assays with and without nuchal translucency measurements) in order to determine the accuracy of maternal plasma cell-free DNA testing for diagnosis of aneuploidy. The cell free DNA testing detected all cases of aneuploidy. For trisomy 21 and 18, the false positive rates were significantly lower than those for standard screening (0.3% vs 3.6% for trisomy 21, p<0.001; and 0.2% versus 0.6% for trisomy 18, p = 0.03). The positive predictive values for cell free DNA versus standard screening was also superior (45.5% versus 4.2% for trisomy 21 and 40.0% versus 8.3% for trisomy 18).


This cohort study of the nationwide Medicaid Analytic eXtract included 949,504 women who were pregnant between 2000 and 2007 of which 64,389 (6.8%) used antidepressants during the first trimester. Although the unadjusted analysis showed a relative risk of 1.25 (95% CI 1.13 – 1.38) for structural cardiac defects, the fully adjusted analysis restricted to women with depression showed no increased risk (RR1.06, 95% CI 0.93 –1.22). The authors conclude that this cohort study “suggested no substantial increase in the risk of cardiac malformations attributable to antidepressant use during the first trimester.”


These authors assessed 23 low-risk women between 36 and 40 weeks’ gestation and performed Doppler flow velocity waveforms on the fetal middle cerebral and umbilical artery in the supine and left lateral position. The pulsatility index in the fetal middle cerebral artery decreased from 1.78 (+/-0.27) in the left lateral decubitus position to 1.29 (+/-0.16) in supine position (p<0.0001). Peak systolic velocity decreased from 46.05 (+/-7.85cm/s) to 39.43 (+/-7.95cm/s), respectively (p=0.001). The pulsatility index in the umbilical artery decreased from 0.89 (+/-0.13) in the left lateral position to 0.74 (+/-0.11) in the supine position (p<0.0001). The authors state that “this study demonstrates that the supine position in late pregnancy, causing aortic and venacaval compression, leads to brain auto-regulation that activates the brain sparing effect in the fetus.” They comment that assessment of this brain sparing effect could be used in other studies to assess fetal compromise.

Neonatal Care

This report from the ACOG Task Force on Neonatal Encephalopathy outlines the assessment process for distinguishing hypoxic ischemic encephalopathy from other forms of neonatal encephalopathy when clinicians are attempting to establish a link between an acute intrapartum event and a poor neonatal neurologic outcome. This report differs from previous editions of the report in that it recommends a more comprehensive multidimensional assessment that includes all potential contributing factors including maternal history, obstetric antecedents, intrapartum factors, and placental pathology. The authors outline the neonatal signs consistent with an acute peripartum event including low Apgar scores at 5 and 10 minutes, fetal umbilical artery pH less than 7.0 or a base deficit > 12, distinct patterns of MRI imaging obtained between 24 and 96 hours of life, and the presence of multisystem organ failure.


This study followed up with school-age assessment on children who were in the French PREMAG trial which randomized mothers of preterm (<33 wks or earlier) fetuses threatening delivery to either magnesium or placebo. This prior study demonstrated a neuroprotective effect of magnesium. This study did not have the power to support the benefit of the magnesium exposure. However there were trends toward reductions in qualitative behavior disorders, cognitive difficulties, school grade repetition, and education services among the children who were exposed to magnesium prior to birth.


These authors assessed a multidisciplinary practice plan designed to keep premature infants <35 weeks old warm after delivery (admitting axillary temperature <36 degrees C without increasing exposure to a temperature >37.5 degrees C). They implemented the use of an occlusive wrap, a transwarmer mattress, and a cap for all infants as well as maintained an operating room temperature between 21 degrees C and 23 degrees C. The practice plan was associated with a significant increase in the newborns’ admitting axillary temperatures, a decrease in the number of infants with moderate hypothermia, and a reduction in neonatal intubation at 24 hours.


These authors report a 5-year quality improvement project involving a thermoregulation bundle. Introduction and optimization of the bundle decreased the incidence of hypothermia, with rates remaining in the target range for the last 13 study months. The incidence of temperatures >38 degrees C was about 2% both before and after bundle implementation.


This double-blind study administered pregnant women with a clinical diagnosis of chorioamnionitis either 100mg/kg N-Acetylcysteine every 6 hours or placebo. The authors found rapid placental transfer of the drug with a cord to maternal ratio of 1.4 ± 0.8 suggesting a slower rate of fetal clearance, with babies closer to term clearing the drug more quickly than those more preterm. Because animal models have demonstrated that N-Acetylcysteine provides neuroprotection in hypoxic ischemic brain injury and in maternal inflammation, this study shows that antenatal neuroprotection may be possible through N-acetylcysteine administration to mothers with chorioamnionitis. This study was not powered to assess neonatal outcomes.


This multicenter randomized controlled trial assigned neonates to one of four hypothermia groups; 33.5 degrees C for 72 hours, 32.0 degrees C for 72 hours, 33.5 degrees C for 120 hours, or 32.0 degrees C for 120 hours. The primary outcome of death or disability at 18 to 22 months is ongoing. The trial was closed at 364 neonates enrolled (of 726 planned) because a futility analysis determined that the probability of detecting a statistically significant benefit for longer cooling, deeper cooling, or both for NICU death was less than 2%. The authors concluded that “among neonates who were full-term with moderate or severe hypoxic ischemic encephalopathy, longer cooling, deeper cooling, or both compared with hypothermia at 33.5 degrees C for 72 hours did not reduce NICU death.”

These authors used data from the Centers for Disease Control and Prevention-linked birth and infant death dataset from 2006 through 2009 to assess neonatal mortality in babies delivered in the hospital or in babies delivered by midwives outside of the hospital. The data showed a significantly increased total and early neonatal mortality for home births.

Fetal surgery


The Fetal Myelomeningocele Maternal-Fetal Management Task Force published these optimal practice criteria for institutions who wish to perform in utero myelomeningocele repairs. They define minimal criteria for “a fetal therapy center” which includes an experienced fetal care team, a multidisciplinary spina bifida program, a Level IIIC Neonatal Intensive Care Unit, a labor and delivery unit with around the clock availability of specialists, an IRB, an ethics committee, a maternal/fetal advocate, and an institutional commitment to track long-term pediatric neurodevelopmental outcomes. For the procedures, they recommend strict adherence to the protocol outlined in the Management of Myelomeningocele Study (MOMS trial), which would involve adopting the inclusion and exclusion criteria of the study. The children should be provided long term care in the multidisciplinary spina bifida clinic. The parents must go through nondirective counseling which involves a full disclosure of risks and potential management outcomes as well as reflective period for them to thoroughly contemplate their choice. Finally, each center should agree to join and support a central registry to track outcomes data. Optimally, the centers should be geographically distributed throughout the country to allow access.

Anesthesia effects on the developing brain


This study exposed fetal rhesus macaques at 120 days gestational age to isoflurane anesthesia for 5 hours in utero. Apoptosis of neurons and oligodendrocytes was increased 4.1 fold in comparison to controls. The authors discuss how the oligodendrocytes become vulnerable when they are just achieving myelination competence which results in the neurotoxic potential of isoflurane increasing between the third trimester and the neonatal period in the nonhuman primate brain studied here.


These authors evaluated whether preconditioning with a short exposure to isoflurane would reduce neuroapoptotic changes in neonatal rats. The preconditioned rates were exposed to 1.5% isoflurane for 30-minutes on one day, and then exposed to 1.5% isoflurane for 6 hours the following day. There was lesser neuroapoptotic changes in the cerebral cortex of the rats who underwent preconditioning.


Animal models have previously shown that general anesthetic exposure induces neuronal apoptotic changes in the developing brain with learning and social abnormalities subsequently evident in these animals as adults. This study exposed 6-day-old female mice to six hours of 3% sevoflurane with and without 1.3% hydrogen. At 7-9 weeks, these mice were mated and their maternal behaviors were studied. The mice exposed to sevoflurane without hydrogen lost >50% of their pups (compared to 80% survival amongst controls, p < 0.0001) as a result of lack of maternal nurturing (incomplete nest building, shorter durations of crouching for nursing, fewer pups with milk in their digestive tracts, greater percentage of poorly cleaned pups, greater ratio of scattered pups out of the nest, lower scores on the pup retrieval test.). Co-administration of hydrogen gas with the sevoflurane as an anti-oxidant agent prevented these behavioral alterations. This study adds further animal evidence to the neurobehavioral alterations that can occur as a result of the apoptotic cell death from sevoflurane exposure in newborn animals.


Accompanied by editorial:
Jevtovic-Todorovic V: **Good gas, bad gas: isoflurane, carbon monoxide, and which is which?** Anesthesia and analgesia 2014; 118: 1160-2

This study exposed 7-day-old mice to one hour of 0, 5, or 100ppm of carbon monoxide in air with or without 2% isoflurane. The authors found that the mice exposed to isoflurane had neuronal apoptosis which was measurable by increased cytochrome c peroxidase activity and cytochrome c release from forebrain mitochondria as well as activated caspase-3 cells and TUNEL positive nuclei. Simultaneous exposure of carbon monoxide with the isoflurane decreased these measurable signs of neuronal apoptotic changes. The authors discuss that “low-flow anesthesia designed to re-breathe specific concentrations of carbon monoxide may be a strategy that could potentially prevent anesthesia-induced neurotoxicity in infants and children.”


Neonatal rats were either administered saline, saline and ketamine, saline and dexmedetomidine, or dexmedetomidine and ketamine once per day for three days. Neuronal apoptosis in the CA1 region and the dentate gyrus of rats was examined by transferase dUTP nick end labeling (TUNEL) assays. Learning and memory abilities of 2-month old rats were examined by the Morris water maze test. The authors found that dexmedetomidine alone was not neurotoxic to the developing brain and that when administered with ketamine, dexmedetomidine attenuated the neuronal apoptotic effects of ketamine.


These authors anesthetized rats using intraperitoneal propofol for 5 h on postnatal days 4, 5, or 6 and gave controls saline or intralipid. Propofol acutely increased corticosterone levels. The authors conclude that “propofol caused acute increases in corticosterone levels and gamma-aminobutyric acid type A receptor-mediated excitation at the time of anesthesia (and this) may play mechanistic roles in development of exacerbated endocrine responses to stress and neurobehavioral abnormalities.”

181. Nemergut ME, Aganda D, Flick RP. **Anesthetic neurotoxicity: what to tell the parents?** Pediatric Anesthesia 2014; 24: 120-6

This article reviews the history of the research regarding anesthesia risk for adverse neurodevelopmental outcomes in infants and children. The authors “impart a framework from which anesthesiologists may address the apprehensions of parents who actively bring up this issue...(and) discuss whether such a conversation should be undertaken as a part of the consent process.”

**External Cephalic Version**


This randomized, double-blinded, placebo- controlled trial examined 60 term parturients receiving either remifentanil infusion with patient controlled boluses or saline placebo during external cephalic version (ECV) attempts. Mean pain scores immediately after attempted ECV were lower and overall maternal satisfaction scores were statistically significantly improved amongst women receiving remifentanil compared to saline placebo. However, the overall success rate of ECV (48.3%) was not significantly different between remifentanil and control groups. Cesarean delivery rates were also similar. Nausea and vomiting, dizziness, drowsiness, fetal bradycardia occurrences and baseline oxygen saturation levels were not significantly different in the two study groups. It appears, compared to no additional analgesic treatment, remifentanil achieved a reduction in maternal pain ratings immediately following ECV and increased maternal satisfaction with no additional adverse effects, but did not improve the success of the procedure.


This prospective cohort observational study compared external cephalic version (ECV) in 100 term parturients administered 2 liters of hypotonic saline to a historical control cohort of women who underwent ECV without additional hydration. Although prior studies suggest that an amniotic fluid index(AFI) >13 cm results in greater success with ECV, this study was not able to achieve a significant increase in ECV success between cohorts, even considering a marked increase in AFI (posthydration AFI 16.13 =/−3.96 cm vs 12.47 =/−3.85cm in controls). In fact, ECV success was actually non-statistically lower in the hydration (43%) than the control group (47%). No clinically significant fluid or electrolyte imbalances occurred in the hypotonic saline group.
Anesthesia and Lactation


Followed by letters to the editor:
Camporesi A, Silvani P: Comment on 'Safety of the breast-feeding infant after maternal anesthesia' Dalal PG, Bosak J, Berlin C. Pediatric anesthesia 2014; 24: 453

Dalal PG, Berlin C: Response to Silvani and Camporesi, regarding their comment on our paper Safety of the breast-feeding infant after maternal anesthesia. Pediatric anesthesia 2014; 24: 453-4

This article reviews the literature on anesthetic drugs administered to nursing mothers and the passage of these drugs to the neonate. They state that very small amounts of propofol, thiopental, and etomidate can be found in the milk or colostrum of mothers after a general anesthetic. There is no data on ketamine, nondepolarizing muscle relaxants or volatile anesthetic agents. Opioids and benzodiazepines transfer to the breast milk but the shorter acting drugs such as fentanyl and midazolam administered in single doses to nursing mothers are “considered safe in lactating women.” Local anesthetics and anticholinesterases are also considered safe. The authors recommend a general anesthetic for nursing mothers that can include midazolam, propofol, nitrous oxide, any of the volatile agents, neuromuscular blockade and reversal, and antiemetics such as ondansetron and dexamethasone. The authors state that “because the exposure of the infant over 24 hours to most drugs transferred to breast milk is rarely >1-2% of the original maternal dose some anesthesiologists make the recommendation to resume breast-feeding when sufficiently recovered from anesthesia.” They go on to say that “there are no scientific data to support postoperative ‘pump and dumping’ unless the mother is not awake enough to breast feed...” This article resulted in letters to the editor because some did not agree with the authors’ conclusions and because the authors did not address potential neuronal apoptotic changes from anesthetic agents to the developing brain of the nursing babies.


These authors administered 20 women undergoing elective cesarean delivery 0.5% levobupivacaine or 0.5% bupivacaine via epidural catheter and measured maternal plasma and breast milk levels at 30min, 1 h, 2 h, 6 h, 12 h, and 24 hours. The authors’ found that both drugs were measured in the breast milk at 30 minutes. The milk/plasma ratios were 0.34 ±0.13 for levobupivacaine and 0.37 ±0.14 for bupivacaine, in other words, the concentration of both drugs was about three times lower in breast milk than in maternal plasma. Both drugs showed similar decreases in levels with time and were nearly undetectable at 24 hours.

Racial and Ethnic Disparities of Care


This retrospective cohort study of 3129 parturients examined ethnic and racial diversity concerns surrounding utilization of neuraxial labor analgesia. Uniquely, this study investigated preferred spoken language as a variable. It appears language barriers (limited English proficiency) may be contributing to neuraxial local anesthesia use among various ethnic groups. Spanish language and multiparity were found to be independently associated with reduced likelihood of receiving labor analgesia. Additionally, this study highlights the importance of collecting preferred spoken language as a variable in future studies on this topic.


This prospective cohort study of 397 term parturients investigated ethnic and racial diversity concerns surrounding the timing of neuraxial analgesia. Ethnicity categories were collected based on parturient self-identification. The primary outcome was cervical dilation at the time of analgesia request. Study design controlled for education, rationale for placement, labor augmentation, and mode of delivery. The study showed that Hispanic women have 0.5cm greater cervical dilation at time of neuraxial request compared to non-Hispanic whites. This difference was neither statistically significant, nor perhaps a clinically significant. The authors’ conclude that ethnicity/race identification likely played a minor role in accepting and requesting labor analgesia in their cohort.

This study utilized the State Inpatient Database (delivery data from seven states 2008-2011) to specifically explore how racial/ethnic minority-serving hospitals perform on 15 delivery-related indicators and examine whether indicators vary by race/ethnicity within the same category of hospital. Hospitals were categorized as non-Hispanic white, non-Hispanic black and Hispanic-serving if >50% of deliveries corresponded to the specific racial group. Black-serving hospitals performed worse than other hospitals on 12/15 indicators, suggesting that an overall lower performance of these hospitals compared to white- and Hispanic-serving hospitals. Although indicator rates were similar in Hispanic- and white-serving hospitals, the most prevalent indicators examined (complicated vaginal delivery, complicated cesarean delivery, OB trauma) were lowest in Hispanic-serving hospitals. This is an area in need of future systematic review.

Reviewed under “Severe maternal morbidity and mortality in developed countries”

Teamwork
This study evaluated a handover tool which delineates which patients should be specifically discussed with the next call team at sign-out time. The pneumatic is SAFE which stands for Sick patients, At-risk patients (for emergency cesarean delivery, hemorrhage or anesthetic problems), Follow-ups (such as postdural puncture headaches, post-hemorrhage patients, or those with neurologic deficit after delivery) and Epidurals (patients who have epidurals running). The authors found that after they introduced the tool to a team, the team increased specifically handing over patients that fit into the SAFE criteria from 49% to 79% of the time (p<0.0001, OR 4.1, 95% CI 2.19-7.6).

Simulation
191. Marshall SD, Mehra R: The effects of a displayed cognitive aid on non-technical skills in a simulated 'can't intubate, can't oxygenate' crisis. Anaesthesia 2014; 69: 669-77
Reviewed under “The obstetric airway”

192. Siddiqui NT, Arzola C, Ahmed I, Davies S, Carvalho JC: Low-fidelity simulation improves mastery of the aseptic technique for labour epidurals: an observational study. Canadian journal of anaesthesia 2014; 61: 710-
Reviewed under “Asepsis”

Reviewed under “Cardiac arrest”

This simulation study taught PGY2 and PGY3 residents with a didactic session on general anesthesia for cesarean delivery, then followed it with a high fidelity simulation of general anesthesia for cesarean delivery. Then, two months later, repeated the simulation again. The authors found that there was an improvement in the validated checklist scores and nontechnical skills scores from the first to the second simulation.