Syllabus Material:

Methods: Eighty-four (84) journals\(^1\) published in the English language between January 2015 and December 2015, and indexed in Pubmed, were searched to identify the key papers that, directly or indirectly, might be relevant to the obstetric anesthesiologist. This search included basic research, human studies using standard methodologies (systematic reviews, randomized controlled trials, observational studies) and investigations of diagnostic tests/monitoring devices, as well as input from opinion papers and editorials. Each study was evaluated using criteria previously described by the Research Triangle Institute, University of North Carolina for the US Agency for Healthcare Research and Quality.\(^2\) Articles were then categorized by topic (see Index of Topics) and a matrix-analytical approach\(^3\) was used to assess the scientific value of the publication. Studies were entered into a matrix table to attempt to identify whether the new publication adds scientific or clinical knowledge to the topic.

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The guidelines represent the ASA effort to improve care during the perioperative period. The guideline places emphasis on preoperative assessment of the patient, assessment
of the risk for transfusion, and the use of adjunct medications. This includes: greater use of pharmacologic therapies to minimize blood transfusions, such as erythropoietin for the anemic patient, prothrombin complex concentrates for urgent reversal of warfarin, and intraoperative antifibrinolytic therapy during selected cardiac and non-cardiac procedures having a high risk for bleeding. Also, the use of transfusion algorithms, especially those based on thromboelastographic testing, blood ordering schedules, and restrictive transfusion strategies.


Several studies have demonstrated an association between school performance and preterm birth. It is hypothesized that some of this association may be confounded by socioeconomic and educational contribution from the mother. The study examined a cohort of over 1.6 million births in Sweden, categorizing subjects by their gestational age, and comparing them with their school-age accomplishments. Analysis was also performed controlling for maternal education and for siblings who were born at 40 weeks. The study found that the unadjusted cohort of children who were born before or after 40 weeks had a significantly lower school age success performance compared to those who were born at exactly 40 weeks. However, after adjusting for maternal education and also siblings who were born at 40 weeks, this difference disappeared. School performance was not affected by preterm birth for children who were born after 31 weeks.


While regional anesthesia has become the preferred technique for cesarean delivery, general anesthesia is sometimes required. This study examined unplanned conversion to general anesthesia in 4300 women over a six-year period. The study excluded urgent and emergent cesarean delivery, and focused only on those where adequate time to provide neuraxial anesthesia was available. Epidural anesthesia had the highest rate of conversion (11%: 15/132), followed by spinal (1.7%: 67/3831), and combined spinal-epidural (0%: 0/291). Conversion was associated with maternal hemorrhage and neonatal respiratory compromise.


This large retrospective study linked multiple databases together to identify health risks/benefits of breastfeeding versus bottle (or both). In the first six months of life there was a 20% and 40% increase in the risk of hospitalization for partial- and bottle-fed babies compared to exclusive breast feeding. Similarly, there was a small, but real,
increased risk of illness later in life for bottle fed children – mostly due to higher risk of infections or immune-related illnesses.


ACOG declaration of maternity care levels similar to neonatal care levels. Importantly, in this document the need for anesthesiologists as consultant (Level II), and specifically obstetric-anesthesia trained or experienced as director (Levels III & IV) are mandated.


Multiple studies have demonstrated an effect of volatile anesthetics on the growth, development or survival of neurons in the young animal brain. This study examined neuronal and mitochondrial effects of repeated neonatal exposure to sevoflurane affects rat brain development. Rat pups were exposed to 2 hour, 6 hour, or three 2-hour exposures. Repeated exposure was worse on dendritic spike formation than single, 6-hour exposure, but both affect apoptosis and mitochondrial toxicity equally. The pattern of neuronal loss was similar regardless of the duration of damage. This demonstrated an anesthetic-specific effect.


After a dural puncture, cerebrospinal fluid (csf) enters the epidural space. Blood injected during an epidural blood patch (EBP) will encounter this csf. The effect of csf on the formation and strength of blood clot is little studied. In this in vitro study, samples of blood and csf were collected from 34 women during spinal anesthesia for cesarean delivery. Samples were then serially diluted up to 30% with either csf or Hartmann’s solution as a control group. Clot formation was measured using thromboelastography (TEG). Dilution with csf produced progressive shortening of the r-time, k-time, and alpha angle, interpreted as facilitating coagulation. There was also a 10% reduction in MA, interpreted as reduction clot strength. Of note, the MA was still within normal values - even on the upper end of normal. The authors interpret this to support larger volumes for injection during EBP, and also a delay in performance to avoid excess csf.


Fetal and maternal inflammation is associated with poor neurologic outcome in the child. Neurologic outcome has been correlated with increased cytokine levels; however,
these studies have not discriminated between maternal and fetal generation of cytokines. The authors studied 25 parturients and examined the levels of cytokines (Il-1, Il-6, Il-8, Tnf-a) in the mother at ROM, and delivery, and in the umbilical vessels, and correlated them to the placental pathologic findings. Neurologic evaluations were performed at six months. Clinical chorioamnionitis (CCA), histologic chorioamnionitis (HCA) and fetal-sided inflammation (funisitis) were concordant in a minority. IL-6 and IL-8 were higher in <32 week gestations, and all cytokines were elevated in both mothers and fetus when funisitis was present. Fetal-sided placental inflammation and cytokine elevations were associated with poor neurologic outcome. Funisitis, and not HCA or CCA, may be the link between inflammatory cytokines and neurologic outcome.


The nocebo effect is the opposite of the placebo effect – a negative effect caused by an inactive treatment. In this study, investigators applied a study cream to 150 healthy volunteers divided into six groups: placebo instruction, nocebo instruction, and reduced information for both EMLA cream and inert cream. Nocebo effect led to an increase in subjective pain to heat, even when EMLA cream was applied. Placebo reduced the subjective sensation of pain.


This investigation was conducted to determine whether condition-specific protocols would improve patient care in obstetrics. Data from 4 years at 25 hospitals was examined resulting in 115,502 patient deliveries. Protocols for hemorrhage and shoulder dystocia were not associated with any change in outcome (risk adjusted multivariate model). The preeclampsia protocol was associated with fewer ICU admissions and less persistent hypertension, but not with any change in morbidity. The assumption that having a protocol improves outcome was not supported in this study.


Non-obstetric surgery in the pregnant patient occurs in 1:645 patients in the United States. This review of 23 years of experience at a single center found 121 surgeries in 111 patients (1 per 325 deliveries). The mean gestational age was 29 weeks (range 23 to 36). Eighty-eight (73%) were performed under general anesthesia. Of the 86 patients for whom perinatal data was available, 32 (37%) delivered prematurely, and 9(10%) within one week of the surgery. No association with the type of anesthesia, or the site of surgery (intraabdominal vs. extraperitoneal) was found.

Postpartum hemorrhage has increased in frequency in the developed world. The choice of uterotonic agent – which to use, either alone or in combination – remains poorly studied. In this in vitro study, the authors examined the contractile strength of oxytocin-naive and oxytocin-desensitized myometrial strips. In oxytocin-naive strips, the effect of oxytocin alone produced a maximal contraction, and the addition of ergonovine or carboprost had no added benefit. In oxytocin-desensitized strips, oxytocin alone had a reduced effect. The combination with ergonovine and carboprost with high-dose oxytocin produced the greatest contractile strength, similar to that of oxytocin in the naive strips.


The success of labor analgesia for parturients who have previously had spinal hardware implantation for spinal scoliosis is poorly defined. This prospective study compared these patients with a cohort of normal labor patients - selected as the next sequential patient for the same operator. The time required to place the catheter was slightly longer in the spinal instrumentation patients (6.5 min vs. 4.5 min); however, there was no difference in the bupivacaine requirements during labor. The spinal instrumentation patients also were more likely to require a senior operator to assist in placement.


This paper studied sepsis-related death in the state of Michigan during the years 1999 to 2006. The rate of death due to sepsis was 2.1 per 100,000, which was 15% of all pregnancy-relate maternal mortality. The authors found a very high rate of delay in diagnosis, of inappropriate antibiotic choices, and of failure in escalation of care.


Fetal ECG analysis was approved for use in the US primarily based on several European studies. There has been significant concern that these studies were poorly conducted or that the results may not be generalizable to current clinical practice. This multicenter (16 universities with 26 delivery centers) trial randomized 11,000 term parturients to either fetal ECG or standard fetal heart rate monitoring. There were no differences in any neonatal outcome between groups. Even when assessment of protocol violations was performed (reassigning failures) there was no difference between groups. Fetal ECG analysis was no better than continuous fetal heart rate monitoring (which is no better than intermittent monitoring!).

Maternal cardiac disease is increasing in incidence and is the most common cause of indirect maternal mortality in most developed nations. This study examined 50 pregnancies in 43 patients with a history of acquired cardiac disease (ACS, MI). Although the timing of the primary cardiac event was not available. Adverse maternal outcomes occurred in 10% of patients, including one death 2 weeks postpartum. The incidence of preeclampsia and IUGR were 10% each. Adverse fetal outcomes occurred in 50%, and were mostly related to premature birth.


The use of a second-line uterotonic agent for the treatment of refractory postpartum hemorrhage after cesarean delivery has been minimally studied. This was a secondary analysis of the MFMU multicenter collection of women who underwent cesarean delivery. After exclusion criteria, 1335 women were included in the study. Using propensity score matching, 369 women who received either methylergonovine or carboprost were compared. The women who received carboprost were more likely to suffer hemorrhage-related complications (hysterectomy, uterine artery ligation) as those who received ergot as a second line agent. Examining those women who had first undergone labor with oxytocin, this difference remained, but the confidence intervals crossed equality. Methylergonovine may be a more effective second-line agent for the treatment of uterine atony after cesarean delivery.


The severe H1N1 influenza (4/15/2009 to 6/30/2010) affected pregnant women disproportionately and resulted in significant morbidity and mortality. During the time period of the study, 75 women were confirmed to have died from H1N1, and an additional 34 were probable, which accounts for at least 1.5 deaths per 100,000, and may have been as much as 2.2 per 100,000. This represented 12% of all maternal mortality.


This cluster randomized trial attempted to decrease the cesarean delivery rate at multiple hospitals. The intervention consisted of audits and reviews, attempting to influence caregivers to employ best practices. There was a significant, but miniscule
decrease in the rate (1.7%). The decrease was solely due to the intervention reducing cesarean delivery in low risk pregnancies.


This database study combined data from several sources in the French health care system. They identified 11,824 pregnancy-related ICU admissions in France from 2006 to 2009. The rate of ICU admission was 3.6 per 1000 deliveries, and decreased over the course of the study. The mortality rate of patients admitted to the ICU was 1.3% and was stable over time. The highest ICU admission rate occurred in hemorrhage followed by circulatory complications, but the highest mortality and morbidity occurred with AFE and infectious conditions. The rate of anesthesia related ICU admission was 0.2 per 1000 deliveries, but the mortality was above average (6%). In addition to the sample size, the strength of this study was the quality of the data and the linkage of ICU admissions with severity of illness scores and organ injury data.


Intubation and tracheal suction for meconium aspiration has changed from routine use to virtually being eliminated from resuscitation protocols - being used only in non-vigorous neonates. This prospective study identified 122 non-vigorous neonates (out of 16,000 live births) who were born through meconium stained amniotic fluid, and randomized them to tracheal suction or conservative support. Tracheal suctioning had no effect on the outcome of neonates. Meconium induced lung injury is an in utero event, and is not influenced by the provider at the point of delivery.


The hypercoagulable state of pregnancy results in a significant risk of thrombosis and complications such as pulmonary embolism. Thromboembolic complications have risen to become one of the leading causes of maternal mortality in the developed world. Current measures of low molecular weight heparin (LMWH) are indirect measures that determine serum concentration, not the degree of anticoagulation. This study examined the thrombin generation assay (TGA) vs. Factor Xa levels in 41 pregnant women with thrombophilias and 40 normal controls. The study found significant individual variation in the anticoagulant effects of LMWH, including two patients who had normal coagulation at high Factor Xa levels. As a measure of anticoagulation effect, the TGA may become a more useful test during pregnancy. Importantly, this may aid the
anesthesiologist in determining the safety of neuraxial anesthesia in patients receiving LMWH.


The implication of medications, specifically anesthetics, on the neurodevelopment of the fetal and neonatal brain remain controversial, but the number of studies demonstrating a deleterious effect in animals is concerning. This study attempted to identify whether sevoflurane administered in the early neonatal period led to autism-like behavior. The study found it did not, but did induce long-term learning impairment.


The maternal response to pregnancy has been associated with long term outcomes such as diabetes, cardiac disease, and stroke. This 5-decade longitudinal study of >15,000 women examined outcome the cardiovascular disease (CVD) based on disorders in pregnancy. The study found that hypertensive disorders in pregnancy including preexisting hypertension, small for gestational age neonate, and glycosuria were associated with significant increases in CVD in later years. This may provide knowledge for early intervention in women.


Transfusion-related acute lung injury (TRALI) is the leading cause of transfusion related mortality in the US. The incidence in the ICU has been found to range between 0.04 % to 8%, but the incidence is believed to be clinically underreported. This retrospective audit of cases of a single-institution, non-cardiac surgery over two years identified 3379 cases of transfusions (2.5% of surgical cases). The authors found 1.3% of surgical transfusions were associated with TRALI. Importantly, there were no cases in obstetrics / gynecologic surgeries.


Transfusion associated circulatory overload (TACO) is the second leading cause of mortality associated with transfusion. Leukocyte reduction was hypothesized to reduce the rate due to reduction in antigenic activation. This study examined the incidence of TACO in 2004 and 2011. Of the 4000 hemorrhages, 400 had TACO. Multivariate modeling found age and year to be the important factors. The rate in obstetrics and gynecologic patients (1.5%) was significantly lower than other surgeries.

Homebirth has increased in recent years. While there are no firm recommendations for advising patients based on risk, the concerns over women with a previous cesarean should be taken into consideration. Unfortunately, there is minimal data on these patients. This secondary analysis of a previous data collection on homebirths in the US examined these patients. There were more neonatal deaths (4.75 per 1000 births) among women who had a VBAC, which was even higher for women with no previous vaginal birth (9.7/1,000). Considering that these are already a selected group of patients, one should recommend homebirth after a cesarean with caution.


The effect of epidural analgesia, and specifically motor blockade, on the efficiency of second stage labor is controversial. This study randomized nulliparous women to receive either Bupivacaine – fentanyl mix vs. high-dose fentanyl solution. No difference on any obstetric, neonatal or maternal outcome were identified (2 min difference in second stage (95%CI -6 to 18). However, the fentanyl-only group received 5 times as much opioid.


This investigation using the National Inpatient Sample examined the complications associated with cesarean delivery. During the period of 2000 to 2011 there was a gradual increase in the cesarean delivery rate. Approximately 0.76% of all cesarean (1% or primary and 0.5% of repeat) deliveries experienced at least one of the 12 pre-determined complications. There was a slight (3.6%) increase in the morbidity rate among primary cesarean deliveries, mostly due to transfusions, renal failure, and shock, but there was a significant decrease in the incidence of anesthesia complications. Over the course of the study period there was an increase in the incidence of placenta accreta among women with repeat cesarean delivery of about 30%.


This is a national review of the 5-year maternal mortality in the US based on the statistics of the CDC, and state records. This examines the 1 year (WHO calculation is based only on the 42-day mortality) pregnancy-related deaths. The overall mortality rate in the US was 16/100,000 births. Most deaths occurred prior to delivery (23%), or within
the 42-day peripartum period (64%). Only 13.5% died after 42 days until one year. The incidence of potentially 'preventable' deaths (hemorrhage, thromboembolism, PIH) have decreased over time, while the incidence of cardiovascular disease, other medical comorbidities, infection, and cardiomyopathy have increased. H1N1 occurred in 2009 and had a significant impact in that year. There is a large disparity with non-Hispanic, black women, and socio-health care issues were identified.


This is a secondary analysis of a retrospective data collection from a single medical center. The authors reviewed the results of placentas examined during one year of clinical care. Approximately 50% of those sent in for pathology had evidence of infection. The authors then combined the data with outcomes of epidural use and fever (>38 °C) during labor. On multivariate analysis, they found that epidural use and placental infection were independent causes of maternal fever during labor. This suggests that epidural analgesia does not cause infection, but is another etiology of fever.


This review examined 4 national guidelines on postpartum hemorrhage. There was considerable variation among the guidelines for definition, diagnosis, prevention, risk factors, and treatment. Furthermore, the evidence used for construction of the guidelines varied considerably. Finally, the authors noted that few randomized studies were quoted. Improvements in how guidelines are created are needed.


This study evaluated the perinatal outcome of 740,000 women who delivered in the Netherlands over 10 years. All patients were selected as low-risk, and were provided primary care with a midwife. The patients self-selected home birth (60%) vs. hospital birth, with about 10% having no selection until the onset of labor. There were no differences in neonatal outcomes, including mortality up to 28 days, APGAR scores <7 or <4, and NICU admissions, with the exception of a slightly higher NICU admission risk among parous women. Important baseline differences in maternal characteristics did exist, including socioeconomic status and ethnicity, both of which were more common in the hospital-birth choice group. With the acceptance of the limitations of the study, primary midwifery care of very-low risk patients in the Netherlands does not have significant difference in perinatal outcome compared to hospital birth.

This large database study of the birth outcomes of Assisted Reproductive Technology (ART) patients included the comparison of patients who used ART with patients who were sub-fertile, but did not use ART to achieve conception, and also fertile women as a third comparison group. Compared to fertile control, both sub-fertile groups had higher rates of pre-term birth and low birth weight, with those using ART having higher rates than spontaneous conception. Among patients with twins, ART was associated with lower risk of perinatal death. The cause of these perinatal complications is unclear.


Necrotizing enterocolitis (NEC) is a major morbidity in very premature infants, which has not changed in incidence despite improvements in neonatal care. This multicenter trial randomized 400 very premature neonates to probiotics (gut bacteria), prebiotics (dietary inulin), a combination of both, versus a control group. The authors found a significant reduction in the rate of NEC among neonates who received probiotic feedings compared to the placebo control and also the prebiotics. On multivariate analysis, antenatal maternal steroids, probiotic use were associated with lower rates of NEC, and maternal antibiotic exposure with higher.


Secondary postpartum hemorrhage (PPH) is defined as occurring after 24 hours up to 6 weeks. This study identified a large cohort of secondary PPH patient to better define causes. The incidence of severe secondary PPH was 0.23 percent (n = 60/26,023), with the mean time of diagnosis being 13 days after delivery (SD 10.8). The incidence was more common after vaginal than cesarean (0.28% vs. 0.08%) delivery. One in five had a primary PPH, while almost half had some perineal trauma during delivery. Retained placenta was most frequently the cause (30.0%), along with subinvolution of the placental bed and endometritis. Twenty one percent (21%) of patients required blood transfusions, surgical management or arterial embolization was required in the majority, including one hysterectomy. While not as common as primary PPH, it is important to maintain awareness so that patients present early.

"Epidural fever" has gained attention in recent years. The cause of a well-documented association between epidural analgesia and a rise in temperature remains undefined. This study randomized women who requested analgesia to epidural vs. IV remifentanil via PCA. A third group of women who had been enrolled by did not request analgesia were included as a comparator group. Women who received epidural analgesia had a higher incidence of temperature >38 C, as well as use of antibiotics. Women administered remifentanil PCA had significantly greater pain and hypoxia. There were some unfortunate differences in obstetric characteristics, including longer labor and higher cesarean rates in the epidural group, which would have perhaps been diluted in from a larger study population. Statistical analysis would be improved with repeated measures analysis, to reduce error, and elimination of the 'control' that were not randomized participants.


Hypnobirthing is popular in the natural childbirth movement. This study of training patients in hypnosis randomized 680 women. There were no differences in any outcome between groups. Nuff said!


Defining competence in procedures is challenging - When does a trainee progress from novice to competent practitioner? This retrospective study examined the success rates for trainees in performance of epidural catheterization. Success was first defined by the performance plateau. Then Cumulative sum analysis (CUSUM) was used to identify the average number of placements that was required before the trainee became competent. The mean number of placements required to achieve 65% success (46 attempts) and 80% success (77 attempts) were calculated.


Modified Early Warning Systems (MEWS; aka triggers) have been developed to more rapidly identify patients who might deteriorate. MEWS have been shown to perform poorly in diagnosing maternal sepsis, in part because of the changes of pregnant physiology. This study examined the test characteristics of six obstetric-specific systems (MOEWS) on a database of patients with known chorioamnionitis and sepsis. None of the six MOEWS performed well and all were similar to the MEWS. This raises the question of whether it is possible to identify impending sepsis in this population with vital
signs alone. It also raises the concern of producing alarm fatigue from the boy who cried wolf (or the MOEWS who identified sepsis).


The use of a ramped pillow has become common to improve visualization during laryngoscopy in the morbidly obese. This study examined the use of a ramped pillow after neuraxial anesthesia for cesarean delivery. One hundred (100) non-obese patients were recruited, randomized to be placed supine or to remain on an upper torso ramp after CSE placement. A significantly higher percentage of ramped patients required supplementation (44% vs. 2%) or general anesthesia (9% vs. 0).


Sleep deprivation leads to an increase in mental and physical error rates. Leading authorities have recommended reduction in the impact of sleep deprivation on physicians - especially those in training. This study evaluated the impact of instituting a night float system for anesthesia residents on the OB anesthesia rotation. Compared with the traditional single-night call structure, night float lead to an increase in accidental dural punctures (relative risk of 2.06), with more of the dural punctures being committed by the first year (i.e. least skilled) residents. This study highlights that the impact of circadian rhythm and cumulative sleep disruption on learning and performance are much greater than a single episode of sleep disturbance.


The administration of oxytocin during cesarean delivery varies in the literature considerably. This prospective trial randomized women receiving a 5 IU oxytocin IV bolus to receive either 200 mg of calcium chloride, 400 mg of calcium chloride, or placebo. The administration of calcium had no effect on the change of blood pressure after bolus administration of oxytocin. There was no change in the assessment of uterine tone. Although this study was slightly underpowered it does not appear promising to use a bolus of calcium to avoid the hypotension expected after a 5 IU bolus of oxytocin.

Post-dural puncture headache remains a significant morbidity after spinal anesthesia. This randomized study examined the incidence of PDPH after prophylactic treatment of ondansetron vs. placebo. 212 parturients were randomized, and there was a reduction in the incidence of PDPH from 20.75% in the placebo group to 4.7% for those given ondansetron; P = 0.001. Criticism of this comes in the use of 25 gauge Quincke needles (similar pencil point needles result in <1% PDPH), the very high incidence of headache in the placebo group, and a question of why a single dose of a medication with a short half-life would result in 3-days of prophylaxis.


MBRRACE-UK is the national survey system for identifying and assessing causes of maternal mortality. The system has evolved over the years, but provides some insight into the changes in causes (aspiration has been restricted) and highlights the potential for improvement in care.


Multiple studies have demonstrated that trained clinicians do not adhere to algorithms such as ACLS, or NRP. This study examined the implementation of a specialized software loaded on a tablet. Subjects (trained neonatal resuscitation teams) were randomized to standard care vs. having the tablet in the crib. The success of decision to provide positive pressure ventilation and chest compressions increased from 60% – 80% in the standard care up to >90% in the intervention group. Decision support tools will become more common in the future.


This interventional trial of team training examined the incidence of emergency cesarean delivery within 30 minutes of declaration. The intervention consisted of a 3-hour training session including lecture and simulation. Data on 100 pre-intervention (baseline) and 100 post-intervention emergency cesarean deliveries was collected. The measure was how many 30-minute cesarean deliveries actually had a decision to delivery interval of ≤30 minutes. The baseline incidence of 74% was increased after training of the staff to 87.5% of all emergency cases. There are several factors that may have impacted the outcome, but it is a good example of a success of a systems-based approach.

Fetal bradycardia after a combined spinal-epidural (CSE) technique for labor analgesia continues to be a topic of interest. In this randomized, double blind study, 596 women were randomized to receive 50 mg of ephedrine vs. placebo immediately after injection of the spinal medication of a CSE technique. The ephedrine group had higher lowest BP during the study period and the placebo group less supplemental ephedrine. The incidence of fetal bradycardia (<90 bpm for >2 min within) 30 min of placement in the ephedrine group was 2.7% vs. 4.7% in the placebo group, which was not significant (p=0.18). The lack of success may be due to the hypotension not being the cause of fetal bradycardia, multivariate causes of fetal bradycardia, or the study being underpowered due to a lower than expected incidence. Routine administration of ephedrine appears to not be effective in a large majority of cases.


This study, conducted in the ICU, examined staff and patient interactions which would lead to adverse events. Staff depression was associated with an increased rate of medical errors, but symptoms of burnout or ‘safety culture’ were not. Other important associations included team turnovers (defined as >40% of that day’s staff having been off the day before) and patients who required labor-intensive care (i.e. the more ill patient).


This qualitative analysis study examined the neurologic outcome of newborns reported with in utero fetal procedures. While there have been fewer randomized studies comparing current fetal therapies with conservative management, the outcomes of some therapies are positive (e.g. laser therapy for twin-twin transfusion syndrome), whereas others do not appear to result in positive neurologic outcomes. Without truly randomized studies it is difficult to say with precision how the interventions affect neonatal neurologic outcome. However, this paper allows for a more informed conversation with patients.


Physician pay has increased over the last 30 years for multiple reasons. Political and economic pressures are destined to change the financial compensation in medicine. This study demonstrates that reducing physician salaries to levels of comparative professionals would reduce overall health expenditures by only 4% to 6%. Healthcare professional salaries do not explain the growth of healthcare costs.

The impact of thrombocytopenia on neuraxial procedures is a frequent discussion in obstetric anesthesia. The precise "platelet count" where clinicians should feel safe will never be known. This paper adds data to the issue by increasing the number of patients with documented uncomplicated neuraxial placement in the setting of thrombocytopenia (defined as a count of <100,000/ml). Based on the analysis, the 95%CI of a spinal-epidural hematoma would be 0 to 0.6%. However, the data only supports platelet counts above 75,000. One must also consider that the patients who received a neuraxial placement are a selected cohort within a larger population.


Stark racial and ethnic differences exist in maternal mortality. This study examined the incidence of maternal morbidity (postpartum hemorrhage, infection, and perineal laceration) among racial groups. Using a prospectively collected database, 115,000 women were examined for delivery morbidity. Non-Hispanic white women were least likely to experience PPH and infections. Asian women were most likely to suffer a perineal laceration. It is unclear if these differences are due to variations of care – which is unlikely as the patterns of adverse outcomes were consistent among different hospitals – or other factors.


Comparisons of anesthesia-related adverse events (ARAE) are hard due to both patient comorbidities and hospital-related factors. Multilevel modeling can be used to adjust for both of these complex factors and to produce rankings of hospitals based on ARAE rates. Data from the years 2008-2009 were collected to develop the model. There was an ARAE rate of 4.6/1000 discharges. Logistic regression modeling, followed by multilevel risk adjustment was performed to develop the final model. This model was then used to predict the ARAE rates at each hospital based on the known 2010-2011 outcomes. Multilevel modeling and simple risk-adjusted modeling has similar predictive power.


Improving patient safety by reducing preventable harm should be a goal of everyone. This study examined the incidence of anesthesia-related adverse events (ARAE) in New York from 2003 to 2012 among 785,000 cesarean deliveries. The incidence of ARAE was 730 per 100,000 deliveries, with a decrease in the rate over the study
period. At the same time, the rate of non-anesthesia adverse events increased. The vast majority (94%) of ARAE were minor, with headache representing half of these. Major adverse events were strongly associated with maternal mortality. There was a decrease in both minor (23%) and major (43%) adverse events over the study period, despite an increase in maternal comorbidity indices.


Cardiac disease is an increasingly important cause of maternal mortality. This examination of cardiovascular deaths in California from 2002 to 2006 found 64 deaths (2.35 per 100,000), with two-thirds due to dilated cardiomyopathy, and the remaining mostly due to pulmonary hypertension and aortic dissection. African-American women were 8 times more likely to have a cardiovascular death; other associations were public insurance and poor prenatal care, hypertension and obesity. The study review committee felt that there was a strong chance to alter the outcome in 24% of cases with better and earlier diagnosis and treatment.


Ketamine is occasionally used in obstetric anesthesia for maternal pain control during cesarean delivery. This meta-analysis concluded that after intravenous ketamine use, the time to first analgesic request after cesarean delivery is slightly delayed, and there is a small reduction in overall pain and analgesic medication requirement. Side effects were similar between ketamine and control groups. The doses varied greatly among the studies. There was no benefit when used as an adjunct after general anesthesia.


Previous evaluations of aortocaval compression during pregnancy have used radiography with single images, or MRI with limited number of subjects. This study evaluated 10 parturients and 10 control subjects who were placed in the MRI scanner at various angles (0, 15, 30, 45 degrees). Non-pregnant women had no differences in the size of their great vessels at any angle. Pregnant women had compression of the vena cava at 0 and 15 degrees, with relief at 30 degrees. Minimal difference was noted between 30 and 45 degrees. No evidence of artic compression was noted. Finally, there were no hemodynamic consequences to any tilt in the pregnant women. Of note, women who experienced supine hypotension syndrome were eliminated from the study (i.e. those who would have had hemodynamic consequences).
Magnesium is used for the prevention of neonatal ischemic injury and cerebral palsy. In this large, multicenter study, magnesium given prior to 32 weeks was associated with decreased risk of echo-densities and echo-lucencies on cranial ultrasound. This explains only part of the reduction of cerebral palsy. No MRI data was collected, which might have been a better method.

Separation of whole blood into component therapies allows for a greater number of patients to receive necessary and specific treatment. Recent studies of the resuscitation of trauma patients has suggested that there might be a survival benefit to a ratio of blood components that is closer to whole blood (1:1:1), when compared to a red cell heavy transfusion strategy (1:1:2). This prospective comparison of 1:1:1 versus 1:1:2 transfusion strategies in the initial care of the trauma patient found no difference in 24-hr or 30-day mortality. Furthermore, there was no difference in transfusion-related complications. Fewer patients in the 1:1:1 exsanguinated in the first hour (~10 patients total) and this led to fewer exsanguination deaths in the first 24 hours. After the initial resuscitation period, patients receiving the lower ratio did require additional plasma to normalize coagulation testing. Despite the predetermined outcomes of the study being negative, the authors recommend the higher ratio for trauma patients.

This study examined the effects of instituting a labor analgesia program in a hospital in China. Prior to the program, no labor analgesia was used at the center. Baseline and post-program rates of labor analgesia, cesarean delivery, episiotomy and neonatal depression (APGAR<3) were captured. There was a steady increase in the use of labor analgesia, and a decrease in the cesarean delivery rate, episiotomy rate, and improvement in neonatal depression, despite an increase in the delivery volume.

Small studies have suggested that breastfeeding is protective for autism spectrum disorder in the child. In this large study of data collected by telephone survey, breast feeding (either partial or exclusive) for any period of time was not associated with a reduction in the incidence of autism spectrum disorder.
This evaluation of obstetric care in Bangladesh found that, among the hospitals involved with government sponsored safe motherhood programs, the increase in obstetric care, access and training resulted in an increased cesarean delivery rate (16% to 36%). The most common indications were repeat, fetal distress and long labor. The authors were concerned that unnecessary cesarean deliveries were being performed, although the complication rate was low and there were no mortalities.

Cardiac arrest during pregnancy is rare, occurring in about 1:12,000 delivery admissions. While most aspects of cardiac resuscitation are similar to the non-pregnant protocol, some differences do exist. This is the first evidence-based expert consensus document detailing recommendations for maternal cardiac arrest. A MUST!

This investigation of a longitudinal database assessed the association between preeclampsia (Pre-E) and future development of cardiovascular disease (CVD). The mean follow-up of patients was 11 years. The authors found a significant relationship between Pre-E and CVD, which has been demonstrated previously. Unique to this study was the investigation of both severity of the Pre-E and the recurrence in subsequent pregnancies. There was a significant correlation between severe and recurrent Pre-E and future CVD.

The use of neuraxial anesthesia has been reported to increase the success rate of external cephalic version. This study aimed to determine whether the facilitation of version was due to analgesia or anesthesia. In Phase 1, women were randomized to three groups: spinal anesthesia, vs. remifentanil analgesia vs. standard care. Spinal anesthesia resulted in greater success (83%) than either analgesia or standard care (64% for both). In Phase 2, the 18 unsuccessful standard care patients were randomized to spinal anesthesia vs. remifentanil analgesia, and 7/9 successfully verted in the anesthesia cohort, whereas none did with analgesia. Of the secondary endpoints, pain was lowest with spinal anesthesia, sedation highest with remifentanil.

Methods of oxytocin administration vary both by facility and by provider. High doses are known to be associated with side effects and adverse events. This study compared two methods of administration in a placebo controlled, blinded randomized fashion. 60 patients were randomized to receive either a timed bolus administration or a continuous infusion of oxytocin (1 IU per min). There were no differences in uterine tone, blood pressure or side effects. The mean dose of oxytocin received was about half in the timed-rule group (4 vs. 8.4 IU).


The racial differences in outcome can be attributed to various causes. This study examining the US Veterans' Administration examined the outcomes of more than 2 million patients between 1999 and 2004. African American patients had lower overall mortality, and coronary heart disease. Because the Veterans' Administration provides equal opportunity for care, this study demonstrated that it is conceivably possible to improve the disparity in maternal mortality.


This retrospective cohort study examined the incidence of uterine rupture after cesarean delivery in the state of Washington. The cohorts being compared included periviable (22 to 26 weeks) vs. viable (36+ weeks) gestation. Cesarean delivery at periviability compared with term was associated with an increased risk for uterine rupture in a subsequent pregnancy, even after accounting low transverse incision. This study is limited by the retrospective nature, and by several important differences between cohorts, including maternal age, race, hypertension and tobacco use.


This study examined the retrospective outcomes of pregnant women who received CPR in the emergency room compared to age-matched controls. The 157 pregnant women had better overall survival of 36.9% compared to 25.9% than those who were not pregnant women. Among subgroup analysis of patients having a cardiac arrest, non-traumatic injury and being in a setting of an urban teaching hospitals were found to have the best outcomes for pregnant women.

This randomized open-label trial of activated Factor VII for the use in severe postpartum hemorrhage was carried out in eight centers. Of note, much of the clinical treatment of hemorrhage was left to the clinicians in the field. Eighty-four (84) patients were enrolled in the setting of hemorrhage treated with standard methods followed by a one-hour sulprostone infusion (prostaglandin E2). Patients were randomized to receive FVIIa or standard care (no additional uterotonics). The composite outcome was statistically significant for the intervention arm (93% of standard care vs. 52% of intervention arm); there were no differences in blood transfusions between groups. Two patients in the intervention group had postpartum thrombotic events, with one having a PE.


Pregnancy related stroke has increased in prevalence in the past 20 years. In this study, strokes were identified from a database of 81 million admissions (not individual patients). The incidence of strokes has increased by 61% over the 20-year period, with a higher rate among patients with hypertensive disorders of pregnancy (100% increase) than normotensive patients (45% increase). Thirty-one percent (31%) of all strokes occurred in patients with hypertensive disorders of pregnancy and most (69%) were in patients who were normotensive. Strokes in women with hypertensive disorders were associated with more frequent complications and death and having traditional risk factors as well as hypertensive disorders compounded the risk.


The data suggests that, in a healthcare system that is designed accordingly, low-risk parturients who deliver at home or in a birthing center have comparable outcomes with fewer interventions and fewer cesarean deliveries. Little is known about what comorbidities or obstetric conditions define low- vs. high- risk. This study was a secondary analysis of the outcomes of 8180 high-risk women in England: 6691 planned a hospital birth and 1489 planned a home birth. These subjects were previously collected in a cohort of 79,000 deliveries. Significant differences between these groups existed, including the hospital birth group being more frequently nulliparous, having multiple risk factors and especially medical risk factors. The hospital birth group had a higher composite outcome due to neonatal NICU admissions; when this was removed the trend was reversed (not statistically significant due to small number of events). Compared with low-risk women, high-risk women who planned a home birth had a significantly higher risk of an adverse perinatal outcome. While this study is
underpowered, it begins to shed light on the question of who should not be encouraged to have a homebirth.


Visual estimation of blood loss has been documented in multiple studies to underestimate the actual volume. In this study, the authors developed a gravimetric system of estimating blood loss. The study then tested the error of visual estimation among clinicians in a simulated environment. There was a 34% error in visual estimation of blood loss (overestimation) but only 4% of gravimetric. They then evaluated the real-case hemorrhages to assess the performance of their gravimetric system. The found good correlation ($r = 0.7$) with drop in hemoglobin concentration, with larger EBL having better correlation.


Bronchopulmonary dysplasia (BPD) remains a devastating complication of prematurity. Although the pathogenesis of BPD is multifactorial, damage from mechanical ventilation is believed to play an important role. Immediate ventilatory support with CPAP and PEEP in the delivery room have been shown to reduce the need for mechanical ventilation. The authors investigated the use of a sustained lung inflation (SLI) on the incidence of mechanical ventilation at 72 hours in a multicenter randomized study. Of note, the study was randomized, but was not blinded. There was a slight reduction in the need for mechanical ventilation at 72 hours (68% to 55%, $p=0.04$). However, all other outcomes, including the incidence of BPD at 36 weeks were similar. The SLI group had non-significantly higher incidence of pneumothorax and interstitial emphysema. SLI does not appear to reduce the incidence of BPD, despite a slight reduction in MV at 72 hours. This may be due to a recruitment on FRC in premature lungs with the use of PEEP, but without an effect on the course of the disease.


The rate of cesarean delivery has increased internationally for multiple reasons. In China, the one-baby policy has led to a very high rate of cesarean delivery (CD: 46%) and of CD with no medical indication (12%). This study examined 66,000 deliveries from the International Peace Maternity & Child Healthcare Hospital (IPMCHH), Shanghai, China over the course of seven years. Maternal and neonatal outcomes were compared between women who attempted a vaginal delivery (61%, 40,000) and those who requested a cesarean without indication (25%, 16,000). There were no differences in maternal outcomes, including death, hemorrhage, embolism, infection of ICU admission. The neonatal outcome slightly favored on-demand cesarean delivery, with
reductions in birth trauma (0.2% vs. 1.1%) neonatal infection (0.4% vs. 0.7%), and encephalopathy (0.4% vs. 1.8%). This data suggests that for nulliparous patients, a primary cesarean on maternal request may not have negative maternal consequences and may improve neonatal outcomes.


This study examined the impact of coffee intake on 90,000 subjects over a four-year period. The data was collected as part of a longitudinal cancer trial (the Prostate, Lung, Colorectal and Ovarian Cancer Screening Trial). Coffee (both caffeinated and decaf) reduce the risk of death during the study period. Drink 2 to 5 cups a day and don't feel guilty!


MicroRNA modulates gene expression and resultant protein synthesis, and importantly the expression of microRNA changes with physiologic and disease states. In this study, term infants were identified and umbilical cord blood sampled for microarray analysis (73 total infants, 18 controls, 33 with perinatal asphyxia, and 19 with hypoxic ischemic encephalopathy). Umbilical cord blood was associated with down regulation of 67 of the measured microRNA, and upregulation of three. While the clinical meaning of this remains to be determined, this study is the first to demonstrate that there is a specific microRNA identified in cord blood that correlated with neonatal ischemic synthesis.


This study assessed maternal serum biomarkers for evidence of abnormally adherent placentation among 736 women with placenta previa who proceeded to cesarean delivery. Thirty seven (37) of these patients had an accreta confirmed at delivery. Among women with a previous cesarean delivery, high levels of pregnancy-associated plasma protein-A (PAPP-A) had a relative risk of placenta accreta of 8.7. Of the 37 women with confirmed abnormal placentation, 23 (62.2%) underwent cesarean hysterectomy and 32 (86.5%) experienced a postpartum hemorrhage, compared with 9 (1.3%) cesarean hysterectomy and 244 (34.9%) with hemorrhage if the diagnosis was only a previa. This may aid in the early diagnosis and treatment planning for patients with suspected accreta.

Teamwork is essential for optimal patient care. An important component of teamwork is debriefing - after events, after training, or after routine care. This article identifies 13 best practices believed to be important to for optimal debriefing that should be used to enhance the safety culture at every center.

This assessment of national stillbirth rate (fetal mortality >20 weeks) from 2006 to 2012 examined the effect of preventing elective deliveries prior to 39 weeks. The rate of still births by gestational age remained the same throughout the study period. There is an increase in the rate of stillbirth that peaks in the 20-22 week range, and then tapers until 38 weeks. The authors claim that this is evidence that adhering to the 39-week limit for inductions / delivery has not resulted in an increase in stillbirths.

Tranexamic acid (TXA), an antifibrinolytic agent, has been used to treat bleeding in gynecology, urology, as well as cardiac surgery, liver transplantation and orthopedic surgery. The efficacy in obstetric hemorrhage remains less defined. This study examined the use of prophylactic TXA during cesarean delivery. Two hundred (200) patients were randomized to 1 g TXA given 5 minutes prior to incision vs. placebo. Patients also received oxytocin and IM methergine after delivery. The estimated blood loss (EBL) was calculated from the change in hematocrit. The difference in EBL was statistically significant (460 ml vs. 700 ml). While awaiting the results of the WOMAN trial, this is of interest, but does not change practice.

The Control of Hypertension in Pregnancy Study was conducted as an open, multicenter, international, randomized, controlled trial to compare tight vs. not tight control of hypertension in patients with non-proteinuric hypertension in pregnancy (chronic or gestational). Mean protocol time was 11 to 12 weeks in each group. There were no maternal or perinatal differences between groups.

The Council on Patient Safety in Women’s Health Care commissioned a hemorrhage bundle with the goal of defining evidence-based recommendations on four categories: Readiness, Recognition and Prevention, Response, and Reporting and Systems
Learning. The goal is to promote quality improvement projects at facilities to reduce morbidity and mortality from obstetric hemorrhage.


The California Pregnancy-Associated Mortality Review collects extensive data on maternal mortality in California. This database was evaluated for the years 2002 to 2005, which included 2,163,457 live births and 207 pregnancy-related deaths (out of 732 pregnancy-associated deaths). Cardiovascular disease was the leading cause of death (2.3 per 100,000) with African American women being disproportionately represented. Preeclampsia (1.7 per 100,000), hemorrhage and thromboembolism (both 0.9) and AFE (0.8). 41% of deaths were believed to be preventable, with hemorrhage (70%) and preeclampsia (60%) being most common.


Uncontrolled observational study examining the use of a protocol using ROTEM measured fibrinogen effect. The A5 measure, available in 5 minutes, correlates with fibrinogen level. The authors used the A5 to guide administration of fibrinogen concentrate. This was compared with their experience using 'Shock packs' containing 1:1 FFP:pRBC. They found fewer cases of TACO, and trend toward better outcomes.


This was a review of pain scores and opioid consumption after cesarean delivery in Germany. Women who did not receive a PCA had the highest pain scores and reported wishing for more pain medication. The use of a PCA was still associated with poor pain control. Neuraxial opioids were not used (est. 4%). The primary reason to not use more pain medication was due the effects on the infant during breastfeeding.


This laboratory study attempted to produce a model of chorioamnionitis; the hope is to study the fetal neurologic effects in future investigations. This model consisted of transient hypoxia-ischemia of the fetus, followed by lipopolysaccharide injection into the amniotic fluid. Pro-inflammatory cytokines and biomarkers of fetal inflammation developed within one day. This mimics the inflammatory processes of chorioamnionitis.

Peripartum cardiomyopathy is a significant cause of maternal morbidity and mortality. This prospective, 30 center collaborative studied 100 women with the diagnosis of PPCM over three years. There were six major events (4 deaths, 4 LVAD implantations, and 1 heart transplantation), with more events occurring in patients with a lower ejection fraction (<30%). Women who presented early in the postpartum course, had a baseline higher EF tended to recover cardiac function to a greater extent. African American were less likely to recover systolic function after diagnosis.


Preeclampsia is known to be associated with poor neonatal outcomes; however, the degree to which these outcomes are solely a function of preterm birth is unclear. This study examined a database of over 200,000 births and compared the neonatal outcome for both preterm and term deliveries between normotensive and preeclamptic mothers. Extensive statistical modelling was performed to ensure the most robust results. Preeclampsia was associated with greater neonatal morbidity even accounting for preterm birth, including an increased odds of perinatal mortality, Small for gestational age, NICU admission, and respiratory distress syndrome, as well as increased odds at term for transient tachypnea of newborn, peri- or intraventricular hemorrhage, apnea, and asphyxia.


Intraoperative red blood cell salvage and reinfusion remains controversial in obstetrics. While the safety seems to be adequate for clinical acceptance, the utilization and cost are poorly defined. The cost of setting up the machine is (est.) $64 while reinfusing units if successful add another $62. This retrospective review of 8 years examined the success of cell salvage overall, and also by indication. Of the 884 patients, only 21% (189) received reinfused blood. The indication that appeared most appropriate was cesarean hysterectomy (79% of cases) and postpartum hemorrhage ((69% of cases), while simple cesarean delivery was not likely to require reinfusion (13% of cases). It is not clear from the report whether cases of cesarean hysterectomy were identified preoperatively or during the case.

The treatment of hypotension after spinal anesthesia remains a heavily discussed topic. Phenylephrine dosing varies among centers and studies between bolus dosing and continuous infusion. In this randomized study comparing three doses of phenylephrine administered by bolus, these authors found that 100 mcg, 125 mcg, and 150 mcg were equally effective at treating the first episode of hypotension. Furthermore, there was no difference in side effects, including N/V, hypertension or bradycardia, or need for further treatment. Neonatal outcome, including blood gas analysis was similar between groups.


The World Health Organization recommends that the cesarean delivery rate for countries be limited to 10 to 15 percent. This analysis of contemporary outcomes studied national cesarean rates and examined both maternal and neonatal mortality. Cesarean rates below 19% were associated with increased maternal and neonatal mortality. Above 20% the outcomes were stable among countries in terms of neonatal and maternal mortality. The ideal modern cesarean rate is likely above 20%.


Skin to skin contact (SSC) has been demonstrated to be of mild benefit to term births. The effects on preterm infants was investigated in this study. Families were randomized pre-birth to continuous (~19 hours) of SSC versus standard care (voluntary SSC which resulted in approximately 6 hours per day). Infants were similar at birth. The measured outcomes were salivary cortisol, measured in both mom and infant, as well as stress and depression scales. The infants in the SSC group had lower response to diaper change at one month and lower baseline resting cortisol at 4 months. The correlation of cortisol in response to stress between mom and infant was present in the SSC group. Fathers in the SSC group were slightly more distressed.


Workflow consistency, including devices such as checklists, has been demonstrated to improve productivity in many industries. Translation into the operating room has been promoted as a method to enhance patient safety. In this study, a group of Standard Operating Procedures (SOP) were developed in operating theaters using a cohort control/active design. A pre-intervention period of assessment was undertaken, followed by training in the Active group. Staff were the cornerstone of the SOP development, including timeouts and sign outs. A PDCA cycle of training and education was used to ensure best practice. The outcomes measured were time, glitches, readmissions, and
completion of timeouts and sign outs using a validated measuring devices. After the 
training period, the Active and Control groups were indistinguishable. The glitch rate 
increased in both groups which was believed to be due to a new IT system.

Standardisation Intervention in Operating Theatres: Controlled Interrupted Time 

Patient safety can be achieved through process improvement and systems engineering. 
The study examined two quality improvement methods, used in combination, to attempt 
to determine if they could enhance patient safety in orthopedics. Standard Operating 
Procedures (SOP) and Crew Resource Management (CRM) team training. The 
combination of the two produced improvements in non-technical skills and improved 
completion of checklists, but did not significantly impact technical performance or 
clinical outcomes.

Labor Disorders and Cesarean Delivery in Nulliparous Women at Term. 

Muscle fatigue leads to the production of lactic acid. This study of 905 consecutive 
nulliparous women found that women with higher amniotic fluid lactate levels has higher 
rates of labor dystocia and were more likely to require an operative delivery. 
Unfortunately, the only laboratory machine available for this measurement is currently 
available for clinical use - but this may eventually add information in the management 
of labor dystocia.

and Difficult Airway Society Guidelines for the Management of Difficult and Failed 

This paper documents the obstetric-specific difficult airway guidelines for the UK. Three 
algorithms cover 1) preparation of the theatre, team, and patient, 2) failed intubation, 
and 3) can't intubate / can't ventilate situations. While the incidence of death from failed 
maternal airway has decreased, the incidence of failed intubation has not changed; one 
can never be too prepared for this challenge.

from Direct Pregnancy Complications: A UK National Case-Control Study. British 

This was an unmatched case-control retrospective analysis of direct maternal mortality 
in the UK collected from national data. Cases of mortality (n=135) were obtained 
primarily from the MBRRACE-UK database (2009 to 2012). The comparative cohort of 
patients with life-threatening complications were obtained from the UK Obstetric 
Surveillance System (UKOSS n=1661) database during the period of 2005 to 2013. Six 
factors accounted for 70% of the maternal mortality, including poor antenatal care;
substance misuse; medical comorbidities; hypertensive disorders of pregnancy; previous pregnancy problems; and Indian ethnicity. Several medical comorbidities, including asthma, autoimmune diseases, inflammatory/atopic disorders, mental health problems, essential hypertension, hematological disorders, musculoskeletal disorders, and infections, contributed 49% to the increased risk of fatality.


Hemorrhage remains the leading cause of maternal mortality worldwide and a leading cause of morbidity in high income countries. The authors postulate that early identification of hemorrhage using the Shock Index (SI = HR/SBP) might capture women at an earlier stage of hemorrhage where intervention could possibly lead to improved outcome. They then studied 10000 deliveries at a single center (high income country), and identified 243 women with PPH>1500 (no description of method). SI was calculated for these women and was highest 15 min after identification of PPH. SI was associated with ICU admission and transfusion, but not a hemoglobin <7g/dl or the need for surgical intervention. There was marginal difference in the SI compared to using HR, SBP, DBP, or PP alone. The target of this study was low income countries, but the index does not appear to be of distinct value.


The inflammatory system is involved in preparation and activation of the myometrium for labor. Blood samples were obtained from women <6 cm of cervical dilation at admission, and at 2 and 4 hours. They found that neutrophils, IL-6, and IL-10 were in greater concentrations among low-risk, nulliparous women admitted in active labor as compared with women in pre-active labor. IL-8, macrophages, and TNF-a were not increased. The levels also increased in both groups over the 4 hours. Inflammation is an essential component of active labor.


This study compared the efficacy of skin prep for cesarean surgery of chlorhexidine-alcohol vs. povidone-iodine with alcohol vs. a combination of both. Forteem hundred (1400) parturients were randomized to three groups, resulting in about 455 per group after dropouts. There were no differences between group based on skin prep. Higher BMI, hemorrhage, surgical time, preeclampsia, and dysfunctional labor were risk factors for surgical site infection.

This study compared the effectiveness of norepinephrine vs. phenylephrine for the management of spinal-anesthesia induced hypotension for cesarean delivery. One hundred and four (104) parturients (101 completed study) were randomized using a computer-controlled infusion program. The computer maintained blood pressure in the programmed range in both groups. The cardiac output was 10% higher in the norepinephrine group as was the heart rate. Calculated stroke volume was similar between groups. Under these tight study conditions, norepinephrine was effective due to the increased heart rate. The safety of this medication will need to be evaluated in multiple contexts.


Women who require cesarean delivery after failure to progress in labor have higher requirements for oxytocin to achieve adequate uterine tone compared to those who have elective, non-laboring surgery. Carbetocin, a synthetic oxytocin analogue with a longer half-life, was studied in using an up/down sequential allocation technique, with a biased coin design to estimate the ED90. The ED90 was found to be above the package insert recommended dose (121 mcg; 95%CI 111 to 130); however, this was suspected of being an underestimate. Unfortunately, the side effect profile was also significant, with 80% of patients having at least one side effect, the most common being tachycardia (57.5%), hypotension (45%), and nausea (37.5%).


This study used a Delphi methodology to identify topic of disagreement between anesthesiologists and obstetricians. Each specialty created a list of topics using the iterative method. These were then cross referenced between specialties. Both groups substantially agreed with the list of topics developed by the other, although the obstetricians often disagreed with the explanation created by the anesthesiologists. This is a good read.


Unless indicated, many practitioners avoid opioid medications prior to delivery during cesarean section under general anesthesia. Due to a very short half-life, remifentanil
has been suggested as a way to provide maternal analgesia during laryngoscopy, while avoiding neonatal depression. This double blind, randomized study compared 1 mcg/kg of remifentanil vs. placebo in 151 parturients. There was a greater incidence of 1-minute APGAR score <8 and of the need for tactile stimulation to encourage breathing in the neonate. However, by 5 minutes this difference had disappeared. Maternal hemodynamics (maximum systolic BP and HR) were lower in the remifentanil group. With the knowledge that a transient depression of the newborn is likely, remifentanil may aid in controlling maternal hemodynamics during induction of general anesthesia.


Fibrinogen represents 85% of the proteins responsible for clot formation. A depletion of fibrinogen has been associated with a greater severity of postpartum hemorrhage. The current methods to measure fibrinogen (Clauss and Prothrombin-derived) require extensive time, or may be inaccurate in the presence of heparin or colloids. This investigation examined a novel method (Dry hematohlogy system (DH)) of measuring fibrinogen in healthy volunteers, and also in samples from cardiac surgical patients. The DH was found to be a rapid and accurate measure of fibrinogen which correlated well with the Clauss method. The thromboelastometric fibrinogen measure (FIBTEM) showed lower correlation with the Clauss method than did the DH method.


Gastric emptying is essential to prevent major injury if aspiration should occur. This study demonstrated that milk emptied at a rate identical to other liquids of similar caloric size (orange juice). Liquid gastric emptying chiefly depends on total number of calories (energy density) rather than compositional differences such as fat content, osmolality, or viscosity. While performed in healthy volunteers, it poses an interesting question for obstetric NPO status.


This paper describes the results of the Kybele organization's work in Ghana Ridge Regional Hospital starting in 2007 through 2011. Teams of volunteers spent 1 to 2 weeks at a time, 2 to 3 times a year, training local caregivers. These efforts resulted in a significant and sustained increase in spinal anesthesia for cesarean delivery (6% pre-program to 95% after completion) despite a large increase in cesarean volume. The effectiveness of spinal analgesia for labor pain control was poor, mostly due to manpower issues. This was an impressive success!
Spinal anesthesia sensory height is affected by several known, and several hypothesized, factors. One such factor includes the pressure in the intra-abdominal cavity. This pressure is often used to explain the higher sensory block achieved in the parturient - without evidence. One hundred and fourteen (114) women at term were enrolled during spinal anesthesia for cesarean. Intraabdominal pressure (IAP) was measured using intra-bladder catheter. When spinal height was T4, the IAP was measured. No correlation between sensory height and IAP was found. In essence, this study examined whether spinal height affects IAP, and not the other way around.

Pruritus is a common side effect of spinal morphine after cesarean delivery. A significant percentage of women report moderate or severe pruritus and request treatment for relief. This study of 137 women found no statistically significant difference between the methylnaltrexone, a peripherally acting mu-receptor antagonist, and placebo. The incidence of pruritus was 84% in the methylnaltrexone group vs. 88% in the placebo group.

This evaluation of the US administrative database was performed to identify the complication rates among women with cystic fibrosis. Eleven hundred (1100) women out of 12 million had cystic fibrosis. Women with the disease were significantly more likely to die during admission (1000 vs. 7.3 per 100,000) and to have other complications. No difference in obstetric outcome or the incidence of hypertensive disorders was noted.

Errors happen; sometimes errors result in patient harm. This study collected the published case reports of medication errors during neuraxial anesthesia. Twenty-nine (29) cases were identified and were classified into 9 error categories. The authors then polled the 5 anesthetic department heads for their opinion on how to prevent these errors. Four practice patterns were recommended to prevent these errors.
The duration of storage of red blood cells may affect the quality of the oxygen carrying capacity. Some, but not all, studies have demonstrated higher morbidity associated with 'old' stored blood. This study examined >2500 parturients who were transfused 1 to 4 units of blood (greater transfusion amounts were eliminated). Using generalized propensity matching, they were not able to detect any difference in outcome based on the age of blood received.

Post-dural puncture headache (PDPH) remains a common adverse event in obstetric anesthesia. Not all patients with a dural puncture experience a PDPH. This single-center retrospective study of 10 years of identified accidental dural punctures with a large-bore epidural needle found an incidence of 51% (263/518). There was an inverse association with BMI and a positive association with pushing in labor. Confounders in this study included the greater use of intrathecal catheters in the obese, but no difference in PDPH incidence was found with an intrathecal catheter.

Maternal stress during pregnancy has been shown to adversely affect the neonate, impacting attention and memory. The authors examined the effects of maternal stress, maternal anxiety, depression and maternal postnatal care on infants. MSDP in the form of life events during pregnancy is associated with both attention skills and spatial working memory during early childhood. Also having some impact were child sex, MADP and/or maternal care.

Propofol induces both pro- and anti-apoptotic mechanisms in the neonatal rat brain. In younger rats (7-days old) this is predominantly widespread apoptotic neurodegeneration, whereas in juvenile rats (14-days old) it results in protective effects. In this study, 14 day old rats were administered propofol by intraperitoneal injection. There was a spike in TNF-α in the cortex and thalamus within 4 hours, which induced multiple downstream pathways, but notably anti-apoptotic proteins especially in the thalamus to different degrees. This could potentially describe the development of neuronal protection by propofol in the juvenile and adult rat, but neurodegenerative effects in the newborn.

Norepinephrine and phenylephrine both can be used to maintain blood pressure. Norepinephrine produced a small but statistically significant decrease in peripheral tissue oxygenation. Might this have implications for the use of norepinephrine in the treatment of spinal hypotension?


Serum Fibronectin (FN) has previously been shown to be elevated in preeclampsia. It was recently found to be elevated in Gestational DM. In this study, Glycosolated FN was noted to be elevated in all trimesters of pregnancy in women who developed preeclampsia. The predictive Receiver Operator Curve was as good as the sFlt/PIGF ratio at identifying preeclampsia. Is this an early gestational marker of endothelial cellular injury?


The rapid onset and short duration of remifentanil make it attractive as a labor analgesic. However, the ideal efficacy and safety have yet to be determined - several adverse cases have been reported. Using a manual device to signal pain, the authors calculated the onset and duration of labor contractions in parturients. Several predictive models were applied to identify when a bolus of remifentanil should be administered. While the complex models performed slightly better, a simple predictive model was found to be adequate. Furthermore, the more complex predictive models did not enhance safety (identified as low serum concentrations between contractions and no bolus without a subsequent contraction). Because of the inherent randomness and short time between contractions, the authors found that concentrations would always be high and continuous monitoring is required.


Plasma cytokines are a key part of the process of cervical ripening and the onset of labor. This secondary analysis of a previous study examined the association between plasma cytokine concentration and labor pain score. Parturients with a lower plasma IL-1β in early labor reported higher pain scores. This is difficult to interpret due to 1) IL-1beta usually being associated with hyperalgesia; 2) higher levels of cytokines being associated with more efficient labor; 3) unmeasured factors in this dataset. It is possible
that low levels of plasma cytokines in early labor are associated with more painful/difficult labor.


This survey assessed the quality and utility of obstetric anesthesia surveys from the UK. The OAA created a system requiring approval of national surveys, and controlled the volume of their use. The study evaluated the surveys in years 1998 – 2012 and found that the number of surveys had increased, and the response rate decreased over time. About 70% of surveys were published in abstract form, and only 25% in manuscript. A survey to assess the surveys was then performed. Approximately 60% of respondents felt the number and quality of surveys was appropriate, and used the information.


This randomized study of PCEA labor analgesia compared three solutions of ropivacaine 0.1% with either sufentanil 0.25 mcg/ml, clonidine 1.5 mcg/ml or clonidine 3 mcg/ml. The outcome measure was the number of provider administered supplemental boluses for breakthrough pain. There were no differences among groups in most measured outcomes and side effects, with the exception of slightly more nausea in the sufentanil group.


The administration of a 3 UI bolus of oxytocin after placental delivery during cesarean has gained popularity as a method of initiating uterine tonicity. Intravenous oxytocin is associated with hypotension and tachycardia, even in small doses. This double blind randomized trial examined the hemodynamic effects of 50 mcg of phenylephrine immediately prior to oxytocin administration. There were no differences between groups, with a 15% to 20% reduction in blood pressure and 14% increase in HR in both groups. This dose of phenylephrine is inadequate to block the effects of an oxytocin bolus.


This interesting study demonstrated the ability to measure serum biomarkers in the maternal and fetal cord blood. These biomarkers are potential causative agents for cardiac injury found in neonatal lupus.
Obesity is a well-known risk factor for preeclampsia. This study investigated the
distribution of fat among parturients to determine if this was a better predictor of the
development of preeclampsia. Truncal obesity is known to be worse in cardiovascular
risk. Both BMI and truncal fat were predictors, with truncal fat being more predictive only
among obese patients. The use of fat distribution did not improve preeclampsia
prediction over traditional BMI.

Non-obstetric surgery during pregnancy occurs in less than 1% of gestations. This study
examined the outcomes of 61 women who had invasive procedures during their
pregnancy, and compared them to 122 women of a control cohort. Invasive procedures
consisted of intraabdominal or urologic procedures. Women who had an invasive
procedure delivered earlier (38.5 weeks vs. 40 weeks) and were more likely to have a
cesarean delivery.

Postpartum hemorrhage remains one of the largest causes of preventable maternal
harm. A 'hemorrhage bundle' was developed and disseminated to 29 hospitals in
California. Compliance with the bundles was monitored in a systematic fashion. During
the observational study period, 2-month time periods were assessed, one prior to, and
two after dissemination. The authors found that the rate of Stage 2 and Stage 3
hemorrhage increased by 40% to 60%, but the use of blood products decreased by
25%. Institution of a protocol, as well as awareness of hemorrhage increased the
available resources at the point of care, which may have led to earlier treatment. This is
hypothesized to have resulted in less need for rescue treatment.

The incidence of ischemic injury to the heart in pregnancy is low, but some studies
suggest close to 5% of parturients will have elevations of cardiac enzymes. This
investigation evaluated 140 women within 24 hours of delivery with a single blood draw
for troponin T. They discovered that 4.5% of patients had elevated levels suggestive of
injury. Interestingly, patients selected as high risk based on published risk factors for coronary artery disease had a lower incidence than the low risk population.


This evaluation of patients receiving a computer-adjusted intermittent bolus of epidural analgesia with continuous infusion demonstrated a marked reduction in breakthrough pain during labor. The computer adjusted the intermittent bolus based on the frequency of patient request (PCEA demand). Breakthrough pain occurred in about 10% of patients, with associated characteristics of dysfunctional labor, high maternal BMI, and excessive number of analgesia demand/received ratio. Breakthrough pain was associated with reduced maternal satisfaction.


Out-of-hospital births have increased over the last decade, with home births (2.4%) and birth center births (1.6%) being the highest in the state of Oregon. Comparisons between in- and out of- hospital births have been complicated by being segregated by final place of delivery, as opposed to intended delivery with home to hospital transfers are treated as a hospital birth. This intent-to-treat evaluation of births in Oregon of almost 80,000 births included 4% out-of-hospital births. Less than 1% (0.8%) (n=601) were transferred to a hospital for delivery. Intended out-of-hospital birth was associated with a higher rate of neonatal and perinatal death (0.63 neonatal deaths per 1000 births and 1.52 perinatal deaths per 1000 births). The odds of most interventions were higher with in-hospital births, except for the need for blood transfusions (adjusted odds ratio, 1.91).


The neurologic effects of anesthetics have become an important field of research. Concern that anesthesia administered in the first few years (and potentially during gestation) may affect brain development is real. This study examined magnetic resonant imaging (MRI) within the first 6 weeks of life. Thirty seven (37) participants (12 with cesareans, 12 with labor epidural analgesia and 13 controls) were examined. Infants whose mothers received any anesthesia had greater local volume in the dorsal frontal lobes bilaterally, left hemisphere of the occipital lobes, and posterior portion of the cingulate gyrus in the right hemisphere. On testing at 12 months, communication and fine and gross motor measures did not differ significantly between the groups. This is a small study, and the limitations are large, and the clinical impact of these findings remains unclear.
Spinal anesthesia has been reported in various studies to be associated with fetal acidosis compared to general anesthesia or epidural anesthesia. The majority of these studies included the use of ephedrine as the vasopressor for treatment of hypotension after spinal anesthesia. Ephedrine is known to be associated with a lower fetal pH than phenylephrine. This retrospective investigation found that spinal anesthesia was not associated with acidosis in the fetus with phenylephrine use, in non-emergent surgeries. In emergent cases, general anesthesia, non-reassuring fetal heart tracing, maternal BMI, maternal DM, fetal anomalies, and any BP<90, or phenylephrine bolus were associated with a lower fetal pH. Then the statistics got over parsed.


Warming of epidural medications has been shown to increase the speed of onset for cesarean anesthesia. The authors used warmed medications (37 vs 20 °C) in a double blinded study of labor analgesia. Bupivacaine 0.125% with fentanyl 2 mcg/cc (20 ml initial bolus) was used. An intermittent bolus technique was used for administration. The time to onset was shorter (9 minutes) with warming, but there were no other differences in continued analgesia or side effects.


Continuous spinal anesthesia has been recommended as a method of providing reliable analgesia/anesthesia to parturients with certain characteristics (e.g. morbid obesity, spine hardware). This prospective observational study examined the attempts to place continuous spinal catheters in 113 women. Nine (9) catheters kinked, 3 were dislodged, the remaining 101 were successful for labor analgesia. Fifteen [(15 of 16) (94%)] were effective for cesarean anesthesia. The PDPH rate was 2.3%. Spinal catheters are as effective/ineffective as epidural catheters, with a higher PDPH rate.


The incidence of patients with congenital heart disease who have reached childbearing age and have become pregnant has increased. This investigation of the National Inpatient Sample Database found an increase in the incidence from 2000 to 2010 (6.4 to 9 per 10,000 deliveries). Not surprisingly, the patients with congenital heart disease
had higher rates of maternal mortality and cardiovascular, pulmonary and obstetric complications. Parturients who had concomitant pulmonary hypertension had worse outcomes compared to those with congenital heart disease without pulmonary hypertension.


Recent investigations have found a link between fever in labor and neonatal encephalopathy. The inclusion of 'epidural fever' has made this relationship concerning. This study of the Swedish Birth Registry included almost 300,000 deliveries over 10 years, 44% of which had received epidural analgesia. Epidural analgesia was associated with a lower APGAR score, but not with neonatal neurologic complications; whereas maternal fever was associated with convulsions and neonatal cerebral ischemia. This study suggests that epidural fever is a benign rise in temperature that is not associated with neonatal neurologic consequences.


This retrospective review examined the use of pain medications after cesarean delivery. Patients received either on demand opioid/acetaminophen (historic control) or round-the-clock acetaminophen with on demand oral opioids. The round-the-clock group required less opioid medication, but received more NSAID's.


This prospective review of 212 parturients with mechanical heart valves examined the maternal and fetal outcomes. Maternal mortality was 1.4% and fetal mortality was 18%. There were also high rates of thrombosis (5%) and hemorrhagic events (23%). While the use of heparin was more likely to be associated with thrombosis, Coumadin was more likely to be associated with fetal loss. Parturients with tissue valves had better outcomes than mechanical valves.


Meta-analysis of the use of tranexamic acid (TXA) in elective cesarean delivery. Eleven randomized studies were included, with 2300 patients. TXA administration was associated with less intraoperative blood loss (average difference of only 140 ml) and a smaller decrease in hemoglobin concentration.

This investigation used the non-inferiority design to test the theory that routine epidural analgesia (EA) was equivalent to on-request services with respect to cesarean delivery rate. The analysis was with intent to treat, as only 89% of women in the routine epidural cohort received the assigned treatment. There was a non-statistically significant higher incidence of cesarean delivery in the routine EA group; however, because the confidence intervals lay outside of the pre-determined lower bound of inferiority (10%), it could not be concluded that routine use was equivalent. Adverse events related to epidural analgesia were more common in the routine EA group, but there were no differences in the obstetric outcomes.


The early diagnosis of preeclampsia might lead to improvement of maternal and fetal care. Recent discoveries of the role of the angiogenic / anti-angiogenic system in the etiology of preeclampsia have led to the potential for improved diagnostic markers. In this study, the use of these anti-angiogenic biomarkers measured prior to 20 weeks, either alone or in conjunction with other signs, did not identify patients who would develop preeclampsia. This, along with other smaller single-center studies demonstrate that anti-angiogenic biomarkers measured prior to 20 weeks do not predict preeclampsia.


Chronic opioid use during pregnancy has increased in recent years. Little data exists regarding the risks and neonatal side effects of various medications used for management of these patients. In this retrospective study, 62 women treated with either methadone, or buprenorphine and naloxone were compared for maternal and neonatal outcomes. Infants born to women who received buprenorphine and naloxone had half the rate of neonatal abstinence syndrome compared to the methadone cohort. They also had lower peak neonatal abstinence syndrome scores and had shorter hospital stays.


The severity of postpartum hemorrhage (PPH) has been inversely associated with fibrinogen in the parturient. Replacement of fibrinogen (which represents the majority of
hemostatic protein) might reduce the amount of blood loss. This prospective, multicenter, randomized, double blinded trial assessed the administration of fibrinogen concentrate (FIB) vs. placebo for PPH. Patient were included if they had a cesarean or vaginal delivery while meeting strict criteria. The subjects who received FIB had a higher fibrinogen at 15 minutes after administration, but the difference was diminished subsequently. No difference was noted between groups for the primary outcome of transfusions in the 6-week period after delivery. Additionally, there was no difference in any secondary measure. While very well designed for preemptive, all-inclusive PPH, a shortcoming of the study was the small number of patients with major hemorrhage, very low fibrinogen (~2%), or need for plasma and platelets (0%).


Enhanced recovery has been applied to several surgical specialties with positive results. This paper reports the outcome of an 11-point pathway applied to elective cesarean deliveries during 2013. Of the 760 cesarean deliveries, 15% (n=114) had early discharge (Postop day 1) and only 4.4% (n=5) of those required readmission. The readmission rate for patients discharged after POD2 were higher than the rate for those discharged on POD1 or POD2. This is not surprising, as the patients who were discharged early were those with an uncomplicated recovery. This observational study of a bundle of interventions demonstrates that selective enhanced recovery after cesarean is possible. The maternal and neonatal benefits or detriments will need to be elucidated in future investigations.


Intrauterine inflammation consists of both chorioamnionitis (inflammation of the maternal tissues) and funisitis (inflammation of the fetal tissues, e.g. umbilical cord). This pathologic examination of 272 placentas from singleton neonates born <34 weeks of gestation found 41% had evidence of inflammation. Eighty percent (80%) of cases of chorioamnionitis had associated funisitis. After adjusting for gestational age, fetal inflammation was independently associated with low birth weight, chronic lung disease, and necrotizing enterocolitis. Maternal inflammation was associated only with necrotizing enterocolitis.


Prostasin, a protease that enhances migration and insertion of trophoblasts, is believed to be integral in placental insertion. MMP (2 and 9) are proteins active in vascular remodeling and are probably associated with placental spiral artery and placental bed
remodeling with gestational growth. Both were found to be reduced in women with
early-onset PEC, less so with late-onset PEC, compared with controls. Prostasin and
MMP9 levels were inversely correlated with SBP, DBP, and with urine protein.

Pregnancy after Bariatric Surgery. International Journal of Gynaecology and
Obstetrics 2015;130:3-9.

Bariatric surgery is increasingly used to treat the obesity epidemic. This meta-analysis
demonstrated a reduction in the risk of gestational DM, hypertensive disorders, and
macrosomia among pregnant women who had bariatric surgery. Unfortunately, there
was an increased risk of SGA newborns. Of note, the authors detected no differences in
cesarean delivery, postpartum hemorrhage, and pre-term delivery.

149. Yousef AA, Salem HA, Moustafa MZ. Effect of Mini-Dose Epidural
Dexmedetomidine in Elective Cesarean Section Using Combined Spinal-Epidural
Anesthesia: A Randomized Double-Blinded Controlled Study. Journal of

A randomized double-blind investigation examining the addition of dexmedetomidine to
a combined spinal-epidural (CSE) anesthetic. The CSE consisted of 5mg hyperbaric
spinal bupivacaine followed by 10 ml of 0.25% epidural bupivacaine with 50 mcg of
fentanyl. Patients were randomized epidural administration of 0.5 mcg/kg
dexmedetomidine vs. saline in the placebo group. The authors found a reduction in the
need for intraoperative supplementation and postoperative analgesia.

Pregnancy-Related OSA without Impairing Sleep Quality or Sleep Architecture

Obstructive sleep apnea (OSA) has been reported to occur in about 5% of pregnant
women. Postpartum, OSA and narcotic pain medications may produce risk. This study
reports the results of polysomnographic testing on 30 women on day-2 post-cesarean.
Using a crossover design, women slept in the horizontal vs. 45-degree upper body
elevated positions. Twenty percent (20%) of the subjects had evidence of moderate to
severe OSA. The elevated position resulted in a 50% reduction in moderate-to-severe
sleep apnea (categorized by an apnea-hypopnea index >15), along with increased
airway diameter, improved apnea-hypopnea index, and lesser arterial oxygen
desaturation. The 45-degree elevated position may be helpful for women with OSA
post-partum.

General Anesthesia and Neurodevelopment: A Systematic Review and Meta-

Exposure to anesthesia in early infancy has been linked to negative developmental
outcomes. This meta-analysis examined exposure to anesthesia by age (before 3 and
after 3) and outcome. They found a small, 18% (95% CI 7% to 30%), increase in risk of negative outcome with early exposure. Significant heterogeneity among studies raises questions, as does the impact of selection bias (infants who require surgery are not an identical cohort to those who do not).