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Obstetric Anesthesia

(Abstracts & Case Report/ Series)

Contents

A Retrospective Cohort Study of the Association Between Labour Epidural Analgesia and Postpartum Depression in Primiparous Women

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Introduction: The prevalence of postpartum depression (PPD) is 6.5-12.9% and it is a significant public health concern that affects the mother, her child, and the family unit.[1] PPD has been associated with the intensity of labour pain[2] and severity of acute postpartum pain[3], making pain a potentially modifiable risk factor for PPD. Thus far in the literature, however, the relationship between labour analgesia and PPD is unclear.4 While some studies have reported an association between labour epidurals and reduced rates of PPD[5-7], others have shown no association between the two[8,9]. The objective of this study was to examine the association between labour epidural analgesia (LEA) and PPD among primiparous women undergoing vaginal delivery.

Methods: Ethics approval was obtained from the local REB. A retrospective cohort study was completed using a provincial perinatal database. The database was searched for all primiparous women who delivered a liveborn singleton infant between 2003-2018. Those women who experienced PPD following their first delivery were identified by searching for a history of PPD in the perinatal records of their second pregnancy. Relevant demographic, medical, obstetric, and anesthetic information was collected from the database. Odds ratios (OR) for the association between LEA and PPD were estimated with logistic regression to control for potential confounding variables.

Results: A total of 35,437 primiparous women were identified who had information about a history of PPD in the record of their second pregnancy. Of this total, 67.3% (n = 23,862) received LEA and 3.7% (n = 1,296) developed PPD. Women who received LEA had a slightly increased odds of developing PPD compared to women who did not receive LEA (OR 1.38, 95% CI 1.22 to 1.57). Further adjustment for other potential confounders (e.g. body mass index, pre-existing anxiety) did not affect the estimated OR.

Discussion: This retrospective cohort study showed an association between LEA and PPD among primiparous women. The findings call into question the hypothesis that LEA decreases the risk for PPD and further illustrates the complexities of PPD.

REFERENCES:

1. N Engl J Med. 2016;375:2177-86.
2. L'Encephale. 2007;33(5):805-10.
3. Pain. 2008;140(1):87-94.
4. Can J Anesth. 2020; [in press].
5. Anesth Analg. 2014;119(2):383-92.
6. Anesth Analg. 2018;126(5):1598-605.
7. Eur J Anaesthesiol. 2019;36(10):745-54.
8. Local Reg Anesth. 2017;10:99-104.
9. Int J Obstet Anesth. 2018;35:10-6

Table 1: The association between epidural use and PPD

	N	N cases (%)	Unadjusted OR (95% CI)	Adjusted* OR (95% CI)
No LEA	11576	346 (2.9)	1.00 (ref)	1.00 (ref)
LEA	23862	956 (4.0)	1.38 (1.22 to 1.56)	1.38 (1.22 to 1.57)

*Adjusted for year of birth, maternal age

Acupuncture for Pain Control After Caesarean Section - Randomized Blinded Placebo-Controlled Investigation with Non-Randomized Arm

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Background: The pharmacological approach alone for pain control after caesarean section (CS) is often insufficient (1,2). Acupuncture is a promising method for mitigating postoperative pain and reducing postoperative opioid requirements (3,4). The aim was to investigate the effectiveness of acupuncture as an adjunctive therapy for pain control after CS compared with placebo acupuncture and standard therapy alone.

Methods: Ethics approval was obtained from the local REB. Patients scheduled to elective CS under spinal anesthesia, were enrolled according to defined inclusion criteria and randomized into the acupuncture group (AG, N=60) or placebo acupuncture group (PG, N=60). Each patient in AG received auricular and body acupuncture with 20 indwelling fixed needles according to a previously validated protocol of acupuncture for postoperative analgesia (3,5). Patients in the PG were treated with placebo needles in addition to standard pain treatment. Another 60 consecutive patients, who were included according to eligibility criteria and received the standard postoperative analgesia alone, constituted a non-randomized “no intervention” (NI) control group. The following outcomes were recorded: pain intensity on an 11-point verbal rating scale (VRS-11, where 0=no pain and 10=maximal pain); analgesics consumption; rate of analgesia-related side effects; time to mobilization and Foley catheter (FC) removal after CS; patients’ compliance and satisfaction with treatment of pain on a 5-point VRS (VRS-5, where 1=excellent; 5=bad).

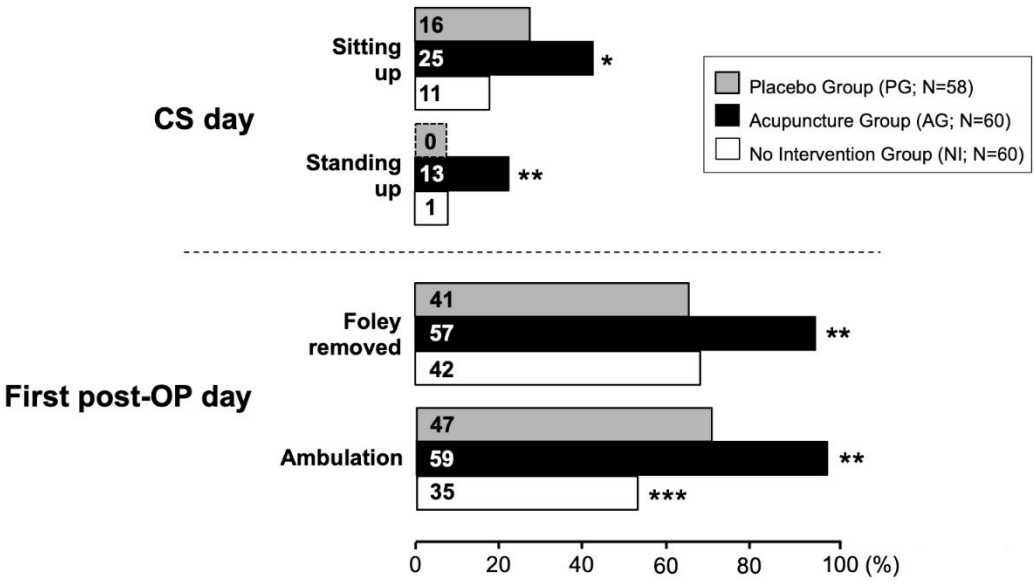
Results: All 180 enrolled patients were included in the "intention-to-treat" analysis. Pain intensity on movement in AG at the first postoperative day was 4.7 ± 1.7 vs. 6.0. ± 2.0 in PG (mean ± standard deviation; VRS-11; P=0.001). The patients from AG demonstrated faster mobilization and removal of FC than those in PG (P<0.01; Figure 1). Patients from NI reported the same pain intensity on movement as patients from PG (5.8 ± 1.7; P=0.8) and delayed mobilization and removal of FC in comparison with AG and later ambulation than PG (P<0.05). Analgesic consumption and other measurement parameters were comparable among the study groups.

Conclusion: Acupuncture relieves clinically relevant pain and accelerates the mobilization of patients after caesarean section. With additional consideration of personnel and time expenditure, acupuncture can be recommended for the routine use for postoperative pain therapy in patients after an elective caesarian section.

REFERENCES:

1. Lavoie & Toledo. Multimodal postcesarean delivery analgesia. Clin Perinatol 2013;40:443–55.
2. Marcus et al. Quality of pain treatment after caesarean section: results of a multicentre cohort study. Eur J Pain 2015;19:929–39.
3. Sun et al. Acupuncture and related techniques for postoperative pain: a systematic review of randomized controlled trials. Br J Anaesth 2008;101:151–60.
4. Tedesco et al. Drug-Free Interventions to Reduce Pain or Opioid Consumption After Total Knee Arthroplasty: A Systematic Review and Meta-analysis. JAMA Surg 2017;152:e172872.
5. Hesse et al. Acupuncture for pain control after Caesarean section: a prospective observational pilot study. Acupunct Med 2016;34:14-9.

Figure 1



Results of patients mobilization after Caesarean Section (CS) on the day of CS and on the first postoperative day. Data given as per cent from total number of patients; numeric values are absolute number of patients; *means $P = 0.03$ for AG vs NI; ** $P < 0.01$ for AG vs PG and AG vs NI; *** $P = 0.03$ for PG vs NI; Fisher's exact test, P-values Bonferroni-adjusted.

Cesarean Section in a Parturient with Neurofibromatosis 1 and Harrington Rods: Is GA the Only Option?

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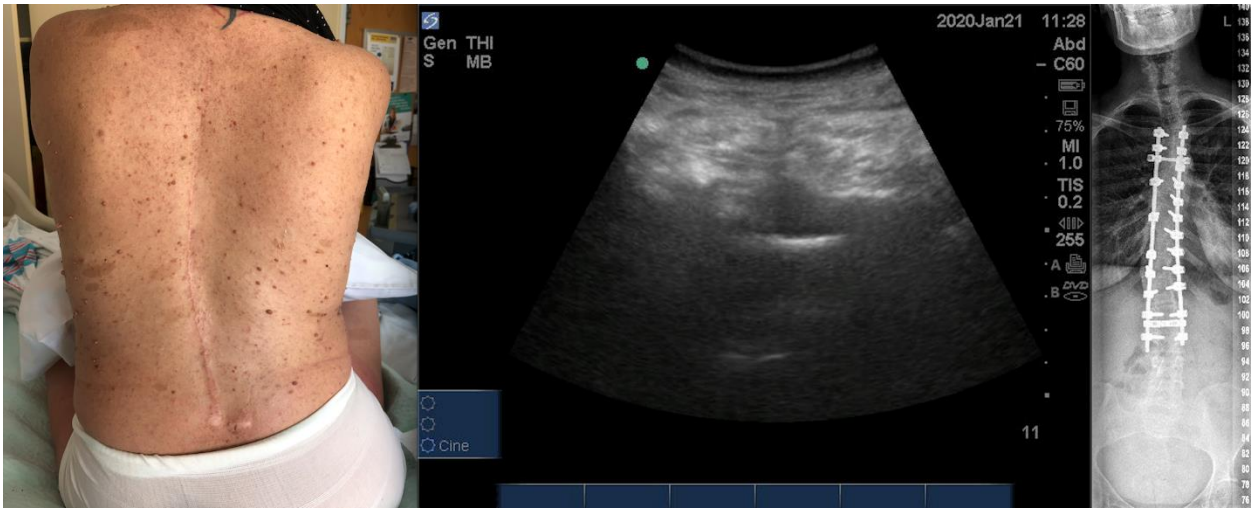
Introduction: Neurofibromatosis 1 (NF1) is a neurocutaneous disorder, caused by a mutation in a tumour suppressor gene, with an incidence of 1 in 2500-3300.[1] Most patients present with café au lait spots and cutaneous neurofibromas. Neurofibromas also develop along peripheral nerves and, less commonly, in the central nervous system (CNS).[1] Neuraxial anesthesia (NA) can be complicated by the presence of peripheral neuropathy, spinal root compression, and scoliosis.[1,2] Additionally, these patients may have difficult airways due to the presence of intraoral tumours and cervical spine involvement.[1] The sequelae of NF1 present several challenges for the delivery of obstetrical anesthesia including the decision to pursue NA or general anesthesia (GA).

Case Presentation: A 31-year-old G2P1 with NF1 underwent an elective repeat caesarean delivery (CD) for breech presentation. She previously had an urgent CD due to non-reassuring fetal heart rate under GA. She had no known history of intracranial or spinal tumours and no neurologic deficits. She had Harrington rods placed from T4-L3 for correction of scoliosis. Plain radiographs confirmed the presence of spinal instrumentation and residual thoracolumbar scoliosis. On physical exam, her airway was reassuring and she had limited flexion in her thoracic and lumbar spine. Neuraxial ultrasound revealed patent lumbar spaces with no subcutaneous tumours appreciated. While the patient expressed interest in NA, informed consent for GA was obtained due to the potential for CNS involvement, the absence of MRI neuroimaging, and the high risk for inadequate block. A healthy baby girl was delivered without perioperative complications.

Conclusion: There are few case reports on the anesthetic management of parturients with NF1. In most cases, an MRI of the spine was obtained to assess for spinal tumours prior to neuraxial anesthesia[3,4] or a GA was performed in the absence of neuroimaging[5]. There is no literature on the management of parturients with both NF1 and Harrington rods. Modern Harrington rods are MRI compatible but their presence distorts the images.[6] In our case, GA was selected because of the paucity of information surrounding the safety of NA without preoperative MRI and the high risk for failed neuraxial blockade. However, with appropriate consent, NA may have been reasonable. Only one complication from a neuraxial procedure in a parturient with NF1 has been reported.[7] The patient developed an epidural hematoma despite no evidence of neurofibroma on MRI.[7] Ultrasound may be an alternative tool to identify large masses in the trajectory of needle placement for NA, but further research into the accuracy of neuraxial ultrasound in detecting neurofibromas is warranted.

REFERENCES:

1. BJA. 2001;86(4):555-64.
2. Brain. 1999;122(Pt 3):473.
3. Can J Anaesth. 1995;42(5):420-4.
4. Proc (Bayl Univ Med Cent). 2018;31(1):92–3.
5. J Clin Anesth. 2007;19:405–7.
6. Eur J Radiol. 2015;84:450–7.
7. BJA. 2001;87(6):932-4.



Electrocardiographic Changes Associated with Epidural Infusion of Ropivacaine in a Patient with SCN5A Sodium Channel Mutation

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Introduction: Inherited ion channelopathies can be associated with a variety of abnormalities of cardiac rhythm and structure. The SCN5A gene encodes a subunit of the cardiac voltage gated sodium channel. Long QT, Brugada syndrome, dilated cardiomyopathy, arrhythmogenic right ventricle have been reported in patients with this gene mutation [1].

Benefits of epidural analgesia include decreasing the risk of cardiac dysrhythmia due to attenuation of sympathetic tone and facilitating obstetric intervention. While less likely than bupivacaine to be cardiotoxic, ropivacaine is also a Na+ channel blocker that can potentially exacerbate ion channel dysfunction. Previously reported use of ropivacaine for neuraxial labor analgesia in a patient with SCN5A mutation was limited to 6.5 hours of labor [2]. This case report describes safe labor analgesia with epidural ropivacaine for 21 hours despite the development of non-specific ECG changes in a patient with newly diagnosed SCN5A mutation.

Case Presentation: Patient consent was obtained for publication of this case. An otherwise healthy primipara reported episodes of dyspnea and palpitations in pregnancy. Due to family history of Long QT Syndrome and dilated cardiomyopathy, she was investigated for inherited conduction abnormality.

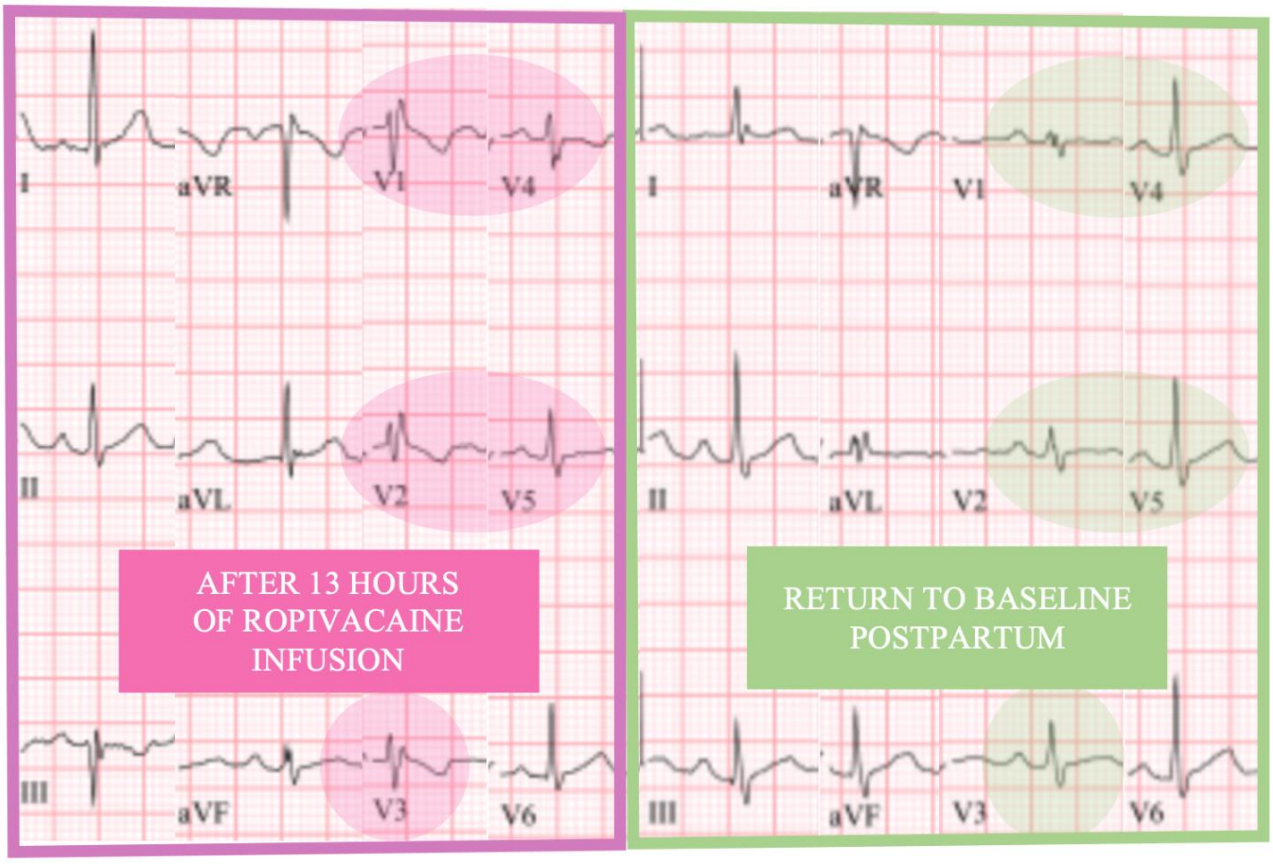
Electrocardiogram and Holter monitor showed sinus tachycardia, RSr' pattern with normal QRS duration and runs of ventricular tachycardia. QT duration was normal. Echocardiogram revealed wall motion abnormality of the right ventricle but normal systolic function. Exact diagnosis was not known at the time of anesthetic consultation at 36 weeks of gestation. Early epidural was recommended due to poor tolerance of tachycardia and the risk of stress related QT prolongation. Avoidance of QT prolonging medication was recommended.

The presence of SCN5A mutation was confirmed several days prior to admission in labor. Labor epidural was induced and maintained using dilute solution of ropivacaine and fentanyl according to standard protocol. As the patient's particular phenotype was unconfirmed, conversion to IV opioid was planned in the event of long QT, bradycardia or ST elevation characteristic of Brugada syndrome. Continuous monitoring revealed persistent sinus tachycardia with evolving partial right bundle branch block and ST inversion. QT interval remained normal. The patient reported several episodes of dyspnea consistent with prior complaints. The duration of epidural infusion was 21 hours. Monitoring was continued for 8 hours post-partum until ECG changes resolved to baseline. The neonate was found to have ST changes consistent with Brugada syndrome.

Discussion: SCN5A mutation of the sodium channel can lead to dysrhythmias including cardiac arrest. Different SCN5A phenotypes can overlap in the same patient. Confirming the specific phenotype and clinical features can help predict consequences of neuraxial analgesia, provoking medications and clinical conditions. A multidisciplinary approach that includes careful monitoring is necessary for safe maternal and neonatal management.

REFERENCES:

1. Journal of Arrhythmia 2013;Apr 29(2): 71-76
2. Case Reports in Anesthesiology 2016, Article ID 9278409



Engagement with a Perioperative Mobile Application for Mothers undergoing Cesarean Delivery: A Prospective Cohort Study

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Introduction: Giving birth is the most common reason for hospital admission, with Cesarean Delivery (CD) being the most frequently performed inpatient surgery (1–3). Lack of knowledge about birth complications and potential warning signs contribute to preventable maternal mortality (4). Through a needs assessment and iterative design process involving patients and obstetric anesthesiologists, we previously developed C-Care, a mobile application for CD (5) focused on perioperative education and self-monitoring of anesthetic complications. This study aimed to measure the extent of patient engagement with the mobile application during a pilot implementation, and obtain quantitative and qualitative feedback regarding feasibility.

Method: Ethics approval was obtained from the local REB. With written patient consent, we conducted a prospective cohort study of patients ≥ 18 years (N=36) having an elective CD. The usage data from C-Care was tracked and recorded for 30 days after CD. On postoperative days 1-5, patients received a short self-monitoring questionnaire. Fourteen days after surgery, patients received an online survey regarding overall satisfaction, potential impact on care, usability and feasibility of C-Care. Qualitative and quantitative metrics were used to evaluate patient engagement. Primary outcomes included: number of views of education topics, completion of self-checks, total visits, satisfaction score, and recommendation to others. Secondary outcomes included: rank of education topics by frequency of views, timing of self-monitoring and mobile application visits, incidence of positive self-check symptoms, knowledge delivery, and feedback for improvement.

Results: Thirty-six patients completed the study from 2018 to 2019. Each participant viewed 4.5 ± 2.5 education topics and visited the application 19.4 ± 14.1 times within 30 days postoperatively. The median number of self-monitoring questionnaires completed was 3 ± 1.3 (out of 5). The top three most commonly viewed patient education topics were “Controlling Pain” on multimodal analgesia, an overview of the postoperative course named “The First Few Days”, and “Contact Information”. Visits to the application were highest within the first week, with the most being on the first two days. Of the 18 respondents who completed the day 14 survey, 83% (N=15) patients recommended C-Care to other women, and the median patient satisfaction score was 7.5 (range 2-10). Patients responded that C-Care provided them knowledge about CD and anesthesia (N=17, 94%), potential complications to monitor for (N=15, 83%), and the recovery process after CD (N=15, 83%). Themes related to improvement included the need for more content, and access to the application earlier during pregnancy.

Discussion: The trends and usage data from this study increased our understanding of patient behavior with a perioperative mobile application in the setting of CD. The findings could help design more effective and tailored patient education and self-monitoring programs.

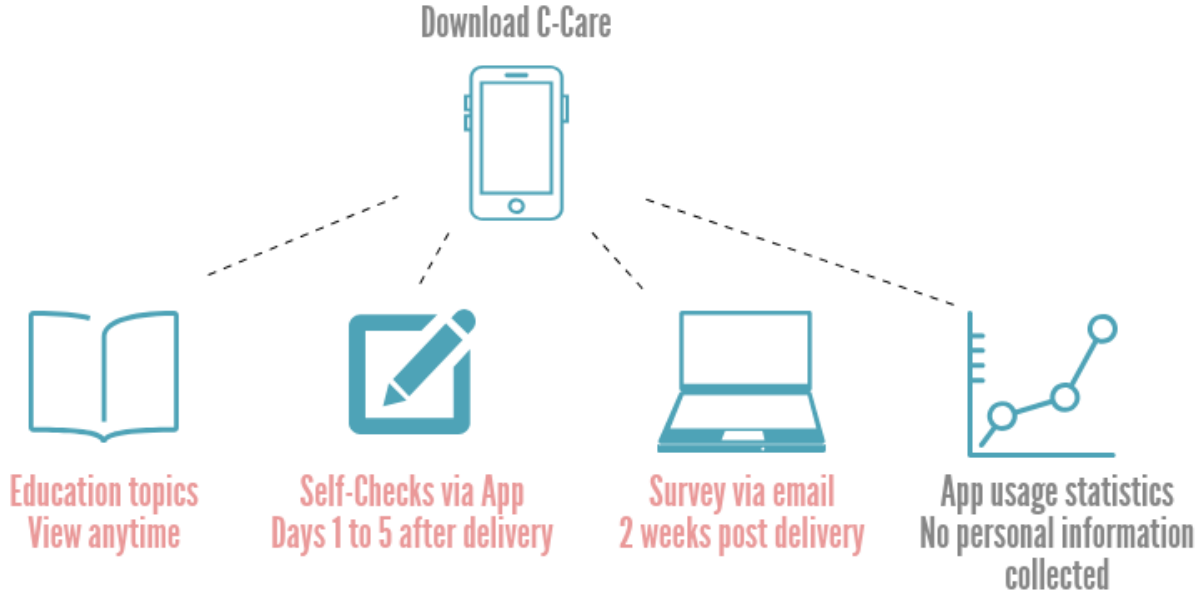
REFERENCES:

1. Canadian Institute for Health Information. Hospital stays in Canada | CIHI [Internet]. 2019 [cited 2019 Aug 10]. Available from: https://www.cihi.ca/en/hospital-stays-in-canada
2. Healthcare Cost and Utilization Project. Most Common Hospital Inpatient Diagnoses - HCUP Fast Stats [Internet]. [cited 2019 Aug 10]. Available from: https://www.hcup-us.ahrq.gov/faststats/NationalDiagnosesServlet
3. Healthcare Cost and Utilization Project. Most Common Hospital Inpatient Operations - HCUP Fast Stats [Internet]. [cited 2019 Aug 10]. Available from: https://www.hcup-us.ahrq.gov/faststats/NationalProceduresServlet
4. Pregnancy Mortality Surveillance System | Maternal and Infant Health | CDC [Internet]. 2019 [cited 2019 May 23]. Available from: https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pregnancy-mortality-surveillance-system.htm
5. Ke JXC, George RB, Wozney L, Chorney JL. Patient-centred perioperative mobile application in Cesarean delivery: needs assessment and development. Can J Anaesth J Can Anesth. 2019 Oct;66(10):1194–201.

C-Care App Study Overview

36 women undergoing Cesarean delivery

- Consent
- Demographics Survey



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Incidence and Outcomes Across Obstetrical Patients Who Receive Extracorporeal Membrane Oxygenation: A Nationwide Inpatient Study in the United States

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Introduction: The use of extracorporeal membrane oxygenation (ECMO) has increased dramatically following reports of successful use across patients with acute hypoxemic respiratory failure and circulatory shock in recent years.[1,2] However, the literature reporting the experience with ECMO across the obstetrical population is sparse. Concerns unique to this population may include maternal and fetal complications.[3] The objective of this study was to determine the incidence, characteristics and outcomes of pregnant patients who receive ECMO. The authors aimed to evaluate predictors associated with the need for ECMO and factors associated with death across pregnant patients who undergo ECMO.

Methods: Ethics approved not applicable because the study did not involve human/animal research. We conducted a retrospective population-based cohort study using the Nationwide Inpatient Sample with weighted estimates of US hospitalizations of obstetrical patients requiring ECMO from 2010 to 2016. Patients treated with ECMO were identified using the diagnostic and procedural codes from the International Classification of Diseases 9th and 10th Edition. We evaluated demographic and obstetrical characteristics, etiologies necessitating ECMO and outcomes. Multivariate regression models were used to identify variables associated with in-hospital mortality.

Results: An estimated 5,346,517 pregnancy-based hospital discharges were identified, of which 59 discharges had an ICD-code associated with ECMO. The use of ECMO in pregnancy has increased over time, with the highest prevalence noted in 2015 (2.3 per 100,000 hospitalizations). The mean (Standard Error, SE) age of ECMO patients was 28.7 (1.3) years, with the majority being white (51%). Two thirds of patients had a Charlson Comorbidity Index of 0 (51%) or 1 (25%). Across ECMO recipients, 25% had pre-existing chronic kidney disease and 17% had pre-eclampsia. Fifty-four percent of patients receiving ECMO had concomitant acute kidney injury and 46% had sepsis (Table 1). The overall in-hospital mortality was 30.5% and the mean (SD) hospital length of stay was 23.8 (3.8) days. Mean (SE) total hospital charges were $ 493,972 (77,013). In our exploratory, multivariable logistic regression analysis, there were no identified demographic characteristics, patient characteristics or complications that were associated with ECMO mortality with the exception of fetal death (Table 1).

Conclusion: Approximately 1.2 per 100,000 hospitalizations during pregnancy in a US-based nationally representative data was treated with ECMO. The mortality among these patients who receive ECMO was 30.5% which, on average, is lower than the general medical-surgical intensive care population treated with ECMO for ARDS or cardiogenic shock. This is likely

attributable to factors including age, health status and indications for ECMO requirements. Based on our findings, the use of ECMO is uncommon in pregnancy and is mostly associated with acute cardiorespiratory complications (including ARDS and pneumonia). Future research should focus on evaluating factors associated with ECMO complications unique to the obstetrical population as well as ECMO outcomes.

REFERENCES:

1. Pineton de Chambrun, M et al. Venoarterial extracorporeal membrane oxygenation in cardiogenic shock indications, mode of operation, and current evidence. Current Opinion in Critical Care. 2019; 397-402
2. Munshi, L et al. Venovenous extracorporeal membrane oxygenation for acute respiratory distress syndrome: a systematic review and meta-analysis. Lancet Respir Med. 2019; 163-172
3. Agerstrand, C. et al. Extracorporeal Membrane Oxygenation for Cardiopulmonary Failure During Pregnancy and Postpartum. Ann Thorac Surg. 2016; 774-779

Table 1. Association between potential etiologies/complications with mortality in pregnant patients treated with ECMO.

	ECMO Prevalence N (%)	OR (95% CI)
Etiologies associated with ECMO utilization		
Acute respiratory distress syndrome	44 (74.6)	0.84 (0.24-2.94)
Acute kidney injury	32 (54.2)	1.50 (0.48-4.62)
Sepsis	27 (45.8)	0.93 (0.30-2.82)
Pneumonia	24 (40.7)	0.30 (0.08-1.07)
Cardiogenic shock	23 (39.0)	1.39 (0.45-4.28)
Cardiac arrest	19 (32.2)	3.1 (0.97-9.96)
Cardiomyopathy	17 (28.8)	1.97 (0.60-6.46)
Septic shock	15 (25.4)	0.78 (0.21-2.89)
Obstetric shock	15 (25.4)	1.19 (0.34-4.18)
Postpartum hemorrhage	9 (15.3)	1.17 (0.26-5.29)
Pulmonary embolism	3 (5.1)	1.15 (0.10-13.5)
Pulmonary hypertension	3 (5.1)	5.00 (0.42-59.1)
Status asthmaticus	2 (3.39)	
Amniotic embolism	1 (1.7)	
Pulmonary hemorrhage	1 (1.7)	
Potential Complications Associated with ECMO Utilization		
RBC transfusion	20 (33.9)	1.93 (0.61-6.09)
Fetal death	5 (8.5)	**11.4 (1.18-111.1)**
Intracerebral hemorrhage	2 (3.4)	2.35 (0.14-39.8)

Bold font denotes a statistically significant result.
Abbreviations: ECMO = extracorporeal membrane oxygenation, N=number of patients, OR=Odds Ratio, CI= confidence interval.

Platelet Membrane Dynamics: A Novel Technique to Identify Procoagulation in Preeclampsia

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Introduction: Preeclampsia is characterized by hypertension and proteinuria, and is often accompanied by thrombocytopenia and subsequent coagulopathy[1]. The exact mechanism of platelet dysfunction is unknown, but we postulate that platelet activation may be part of the pathogenesis, rather than a sequelae of preeclampsia. Systematic analysis of procoagulant membrane dynamics (PMD) in platelets was compared.

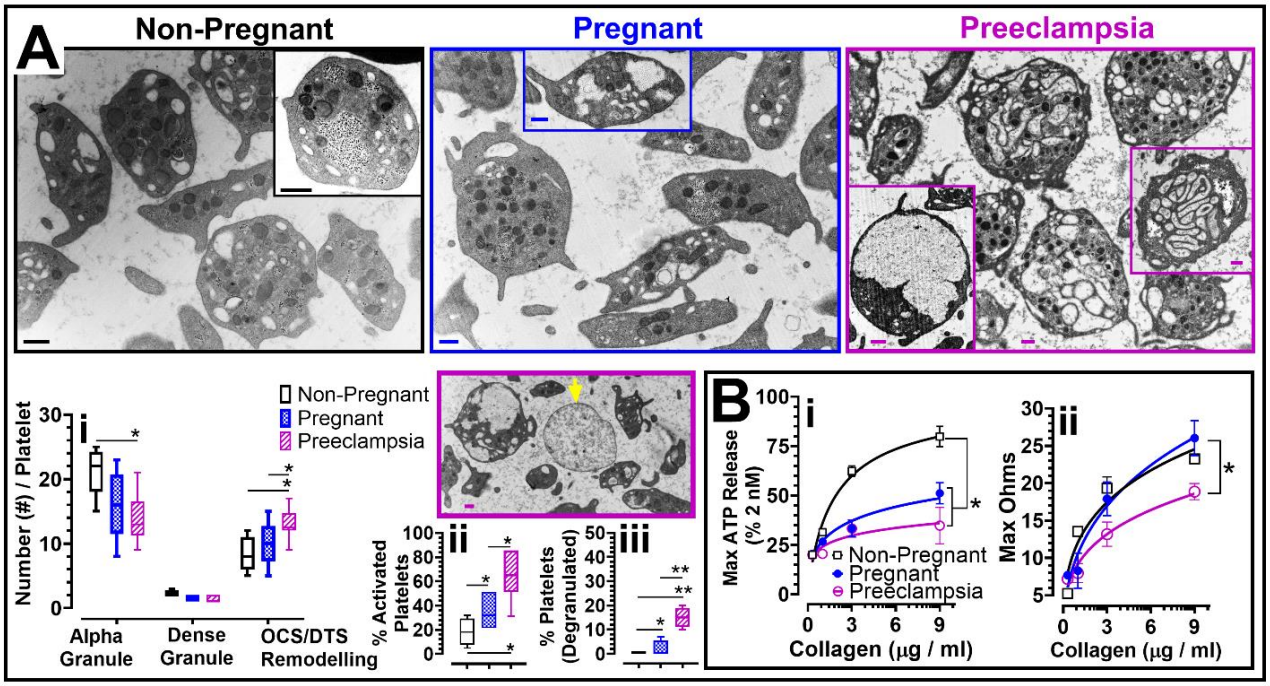
Methods: Ethics approval was obtained from the local REB. A pilot study was performed on 26 patients: Non-pregnant control (C=9), healthy pregnancy (HP=9), and preeclampsia (PE=8). Pregnant participants between 24-42 weeks gestational age were recruited. Those with underlying coagulation abnormalities, or medications affecting coagulation (except for low-dose aspirin) were excluded. Platelet ATP secretion and whole blood aggregation were analyzed by standard impedance aggregometer. 4-D live-platelet confocal imaging was used to quantify markers of granular secretion and thrombin generation indicative of platelet activation on the its outer membrane[2,3]. Image data quantification, 3D/4D reconstruction and movie rendering were performed using Volocity™ software. Clinical outcomes of thrombosis and hemorrhage was followed for 48 hours after delivery in pregnancy samples.

Results: Hypercoagulability in pregnancy was accentuated in preeclampsia. Mean GA was 39±1weeks for HP and 31±4 for PE. Mean platelet count (109/L) was 253±33, 207±41 and 186±63 for C, HP and PE respectively. Preeclampsia platelets were significantly activated at baseline and showed major remodeling of open canalicular system and enhanced P-selectin expression. Paradoxically, there was marked decrease in dense granule release in response to collagen stimulation in preeclamptic platelets. Platelet microthrombi were detected in circulating whole blood in both HP (22%) and PE (75%) and not present in controls. Mean blood loss (ml) for caesarean section was 467±137 for HP (n=6) and 908±76 for PE (n=6) $p<0.01$. There was no difference in blood loss in vaginal deliveries in the 2 groups. No thrombotic events occurred.

Conclusion The decreased platelet count during pregnancy, accentuated in preeclampsia, and increased blood loss at delivery in preeclampsia were consistent with known literature1. The presence of microthrombi in circulation in both HP and PE groups may account for platelet consumption as a mechanism for low platelets in gestational thrombocytopenia and preeclampsia. The PMD studies identified baseline platelet activation in preeclampsia, but a decreased ability to respond to further stimulation. The free microthrombi in suspension noted in peripheral blood in preeclampsia may be the result of sustained platelet activation in preeclampsia. These basally primed platelets then become fatigued and less effective at agonist-stimulated adhesion and aggregation. Further studies are required to correlate these results of PMD with current tests of platelet function, but PMD can potentially utilize the platelet activation process itself to provide biomarkers for staging and phenotyping preeclampsia, and provide prediction for its severity, clinical manifestation and disease progression.

REFERENCES:

1. Valera MC, Parant O et al. Physiologic and pathologic changes of platelets in pregnancy. *Platelets*. 2010; 21:587-595.
2. Agbani EO, Van den Bosch MTJ et al Coofdinated membrane ballooning and procoagulant spreading in human platelets. *Circulation*. 2015; 132:1414-1424.
3. Agbani EO, Poole AW. Procoagulant plaetlets: generation, function and therapeutic targeting in thrombosis. *Blood*. 2017; 130:2171.2179.



Practice of General Anesthesia for Cesarean Section in a Tertiary Care Center: A Retrospective Cohort Study

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Introduction: In developed countries, 20 to 30% of births are performed by caesarean section. The gold standard for caesarean section is neuraxial anesthesia, while general anesthesia is reserved for emergencies and failure of or contraindications to neuraxial anesthesia. This has led to a decrease in caesarean sections performed under general anesthesia and the anesthesiologist's exposure to this practice. The lack of evidence-based recommendations for caesarean sections under general anesthesia can lead to significant practice variability and perinatal morbidity, particularly concerning the use of opioids, which can be associated with neonatal respiratory depression. The goal of this study was to describe the practice for caesarean sections performed under general anesthesia at our institution, along with its complications. We also aimed to identify factors that predicted opioid use at anesthesia induction and the need for neonatal resuscitation.

Methods: Ethics approval was obtained from the local research ethics board. We conducted a retrospective, observational, single-centre cohort study at the Centre Hospitalier Universitaire de Sherbrooke, a tertiary care centre catering to high-risk obstetrics patients. We included all adult parturients who underwent caesarean section under general anesthesia between January 1st 2012 and December 31st 2016. Patients with spinal anesthesia failure or known intrauterine fetal demise were excluded. We collected data regarding anesthetic medication use, maternal medical history, neonatal resuscitation and anesthetic complications. We used a multivariate logistic regression model to identify predictors of opioid use at induction of anesthesia, as well as predictors of neonatal resuscitation.

Results: We identified 234 patients and 194 were included. Propofol was the main induction agent (97.41%; n=188) and 98.45% received neuromuscular blockers (n=193). Opioids were used at induction in 33.5% (n=65) of patients. Maternal age (OR=1.04; IC=0.98-1.09, p=0.18), body mass index (OR=1.03; IC=0.97-1.08, p=0.31) and urgent caesarean section (OR=1.35; IC=0.41-4.47, p=0.63) were not independent predictors of opioid use at induction of anesthesia. Opioid use at induction of anesthesia (OR=2.00; IC=0.78-5.12, p=0.13), non-reassuring fetal heart rate tracing (OR=0.72; IC=0.29-1.82, p=0.43) and incision-to-delivery time (OR=1.02; IC=0.92-1.13, p=0.70) were not independent predictors of neonatal resuscitation. Low gestational age (OR=0.75; IC=0.64-0.87, p=0.0025) was an independent predictor of neonatal resuscitation. The maternal anesthetic complication rate was 0.52% (n=1).

Conclusion: Rapid-sequence induction without opioids is the common practice for caesarean section under general anesthesia at our institution. No maternal independent factors were predictors of opioid use at induction of anesthesia. This is reassuring because of the risk of complications associated with opioid use in obese patients, or for urgent caesarean section with

fetal distress. However, low gestational age was the only independent predictor of neonatal resuscitation. This is coherent with the premature neonate's underdeveloped respiratory system, and suggests that opioids could be used safely in other high-risk situations (i.e. severe maternal hypertension).

REFERENCES:

1. Betrán AP, Merialdi M, Lauer JA, et al. Rates of caesarean section: Analysis of global, regional and national estimates. Paediatric and Perinatal Epidem 2007;21(2) : 98–113.
2. Corri B, James A K, Hershel J. Cesarean delivery in the United Kingdom. Time trends in the General Practice Research Database. Obstet Gynecol 2005; 106 : 151–155
3. Joseph KS, Young DC, Dodds L, et al. Changes in maternal characteristics and obstetric practice and recent increases in primary cesarean delivery. *Obstet Gynecol*2003; 102(4) : 791-800
4. Menacker F, Hamilton BE. Recent trends in cesarean delivery in the United States. NCHS Data Brief 2010; 35:1–8
5. Bucklin BA, Hawkins JL, Anderson JR, et al Obstetric anesthesia workforce survey: Twenty-year update. Anesthesiology 2005; 103:6455-53
6. Djabatey EA, Barclay PM : Difficult and failed intubation in 3430 obstetric general anesthesics. Anaesthesia; 2009:64 : 1168-1171.
7. Devroe S, Van de Velde M, Rex S. General anesthesia for caesariean section. Curr Opin Anaesthesiol. 2015; 28; 240-6
8. Sumikura H. When was the last time you induced general anesthesia for cesarean section? J Anesth.2015; 29:819-820
9. « OMS | Déclaration de l'OMS sur les taux de césarienne ». WHO. Consulté le 30 janvier 2018. http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/cs-statement/fr/
10. McDonnel NJ, Paech MJ, Clavisi OM, Scott KL: Difficult and failed intubation in obstetric anesthesia: an observation study of airway and management of complications associated with general anaesthesia for caesarean section. International Journal of Obstetricc Anesthesia; 2008:17 : 292-297
11. Sumikura H, Niwa H, Sat M, Nakamoto T, Asai T, Hagihira S. Rethinking general anesthesia for cesarean section. J Anesth (2016) 30:268–273 DOI 10.1007/s00540-015-2099-4
12. Hawkins JL. Anesthesia-related maternal mortality. Clin Obstet Gynecol 2003; 46:679–687.
13. Gori F, Pasqualucci A, Corradetti F, Milli M & Peduto VA. Maternal and neonatal outcome after cesarean section : The impact of anesthesia, The Journal of Maternal-Fetal & Neonatal Medicine 20 :1, 53-57, DOI : 10.1080/14767050601134645
14. Lesage, S.Cesarean delivery under general anesthesia: Continuing Professional Development. Can J Anesth/J Can Anesth (2014) 61:489–503 DOI 10.1007/s12630-014-0125-x
15. Practice Guidelines for Obstetric Anesthesia : An Updated Report by the American Society of Anesthesiologists Task Force on Obstetric Anesthesia and the Society for Obstetric Anesthesia and Perinatology . *Anesthesiology* 124, n° 2 (février 2016)

16. Chestnut D,Wong C A, Tsn LC, Ngan Kee W, Beilin Y, Mhyre J. Chestnut's Obstetric Anesthesia: Principles and Practice, 5th Edition. p.459
17. Rucklidge M. Up-to-date or out-of-date : does thiopental have a future in obstetric general anaesthesia ? Int J Obstet Anesth 2013; 22 : 175-8.
18. Meek, T. Traditionnal rapid sequence induction is an outmoded technique for caesarean section and should be modified. Opposed. Int J Obstet Anesth 2006;15:229-32.
19. Tumukunde et al. BMC Anesthesiology (2015) 15:63 DOI 10.1186/s12871-015-0044-6
20. Ngan Kee WD, Khaw KS, Ma KC, et al. Maternal and neonatal effects of remifentanil at induction of general anesthesia for cesarean delivery: a randomized, double-blind, controlled trial. Anesthesiology 2006; 104:14 – 20.
21. Chattopadhyay S, Das A, Pahari S. Fetomaternal outcome in severe preeclamptic women undergoing emergency cesarean section under either general or spinal anesthesia. J Pregnancy. 2014; 2014:325098.
22. Mattingly JE, D'Alessio J, Ramanathan J. Effects of obstetric analgesics and anesthetics on the neonate: a review. Paediatr Drugs. 2003; 5:615–27.
23. Carvalho B, Mirikitani EJ, Lyell D, Evans DA, Druzin M, Riley ET. Neonatal chest wall rigidity following the use of remifentanil for cesarean delivery in a patient with autoimmune hepatitis and thrombocytopenia. Int J Obstet Anesth. 2004; 13:53–6.
24. Draisci G, Valente A, Suppa E, Frassanito L, Pinto R, Meo F, De Sole P, Bossù E, Zanfini BA. Remifentanil for cesarean section under general anesthesia: effects on maternal stress hormone secretion and neonatal well-being: a randomized trial. Int J Obstet Anesth. 2008; 17:130–6.
25. Noskova P, Blaha J, Bakhouche H, Kubatova J, Ulrichova J, Marusicova P, Smisek J, Parizek A, Slanar O, Michalek P. Neonatal effect of remifentanil in general anaesthesia for caesarean section: a randomized trial. BMC Anesthesiol. 2015 Mar 26; 15 h 38. doi : 10.1186/s12871-015-0020-1. eCollection 2015.
26. Bouattour L, Ben Amar H, Bouali Y, Kolsi K, Gargouri A, Khemakhem K, et al. Maternal and neonatal effects of remifentanil for general anaesthesia for caesarean delivery. Ann Fr Anesth Reanim. 2007; 26(4) : 299–304. doi : 10.1016/j.annfar.2007.01.005
27. Mancuso A, De Vivo A, Giacobbe A, Priola V, Maggio Savasta L, Guzzo M, De Vivo D, Mancuso A. General versus spinal anaesthesia for elective caesarean sections: effects on neonatal short-term outcome. A prospective randomised study. J Matern Fetal Neonatal Med. 2010 Oct; 23(10) : 1114-8.
28. Afolabi BB, Lesi FE: Regional versus general anaesthesia for caesarean section. Cochrane Database Syst Rev. (10) 2012
29. Strouch ZY, Dakik CG, White WD, Habib AS: Anesthetic technique for cesarean delivery and neonatal acid–base status: a retrospective database analysis. International Journal of Obstetric Anesthesia (2015) 24, 22-29.
30. Chestnut D,Wong C A, Tsn LC, Ngan Kee W, Beilin Y, Mhyre J. Chestnut's Obstetric Anesthesia: Principles and Practice, 5th Edition. p. 168
31. Apgar V, James LS. Further observations on the newborn scoring system. Am J Dis Child 1962; 104:419-28
32. Yeh P, Emary K, and Impey L: The relationship between umbilical cord arterial pH and serious adverse neonatal outcome: analysis of 51,519 consecutive validated samples. BJOG 2012; 119: pp. 824-831

33. Ray, Joel G., Karyn E. Medcalf, et Alison L. Park. « Association of Newborn Apgar Score With Maternal Admission to the Intensive Care Unit ». *JAMA Pediatrics*170, n° 1 (1 janvier 2016): 88. https://doi.org/10.1001/jamapediatrics.2015.3035.
34. Goldszmidth,, E. Priciples and practices of obstetric airway management. Anesthesiol Clin 2008; 26:109-25.
35. Schneck H, Scheller M. Acid aspiration prophylaxis and caesarean section. Curr Opin Anasthesiol 200;13:261-65.
36. Chestnut D,Wong C A, Tsn LC, Ngan Kee W, Beilin Y, Mhyre J. Chestnut's Obstetric Anesthesia: Principles and Practice, 5th Edition p. 25-26
37. Robins K, Lyons G. Intraoperative awareness during général anesthesia for cesarean delivery. Anesth Analg 2009; 109:886-90.
38. Desprats R, Dumas JC, Giroux M, Campistron G, Faure F, Teixeira MG, et al. Maternal and umbilical cord concentrations of fentanyl after epidural analgesia for cesarean section. Eur J Obstet Gynecol Reprod Biol. 1991; 42:89–94.
39. Apgar V, *The newborn (Apgar) scoring system. Reflections and advice,* Pediatric clinics of North America, 1966;13 :645-650
40. Gilstrap LC, Hauth JC, Hankins GD, and Beck AW: Second-stage fetal heart rate abnormalities and type of neonatal acidemia. Obstet Gynecol 1987; 70 : pp. 191-195
41. Cyna AM, Andrew M, Emmett RS, et al : Techniques for preventing hypotension during spinal anaesthesia for caesarean section. Cochrane Database Syst Rev 2006; (4) : CD002251

Programmed Intermittent Epidural Bolus for Labor Analgesia: an RCT Comparing Bolus Delivery Speeds of 125 mL/h versus 250 mL/h

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Introduction: Programmed intermittent epidural bolus (PIEB) provides better analgesia for labor pain than continuous epidural infusion (1). The PIEB technique seems to be associated with high sensory block to ice in many women (2-4). While this finding is not associated with important side effects, it suggests that the technique could be optimized. Previous studies have shown that higher speeds of bolus delivery generate higher pressures in the epidural space (5), however one study failed to correlate bolus delivery speeds to quality of labor analgesia or complications (6).

Objectives: We hypothesized that a PIEB technique programmed to deliver boluses at 125 mL/h would produce lower sensory levels than at 250 mL/h.

Methods: This was a double-blind RCT conducted with institutional REB approval and written informed consent of all participants. We recruited term nulliparous laboring ASA II-III women with singleton pregnancies during first stage of labor. Epidural catheter was inserted at L3/4 interspace as determined by ultrasound. All women received a loading dose of 15 mL of 0.125% bupivacaine with 50 mcg fentanyl and achieved VNRS ≤ 1 (0-10) for pain at 20 minutes. PIEB was used for maintenance with 0.0625% bupivacaine with fentanyl 2 mcg/mL with the following settings: PIEB bolus 10 mL Q 40 minutes; PCEA 5 mL; lockout 10 min; hourly max 30 mL. Manual top ups were administered if required. Women were randomized to receive the PIEB regimen at two different delivery speeds: Group 250 (G250): 250 mL/h; Group 125 (G125): 125 mL/h. In-charge nurses assessed pain scores, sensory block to ice and motor block hourly. The study was terminated six hours after epidural initiation or when women were fully dilated, whichever came first. Primary outcome was the upper sensory block to ice.

Results: Data from 81 women were analyzed (G250: 39; G125: 42). Incidence of women presenting at least one sensory block assessment ≥ T6 was not different (G250 74.4% vs. G125 61.9%, p=0.23). The incidence of women presenting sensory block ≥ T6 in more than 25% of the assessments was significantly lower in the G125 (61.5% vs. 28.6%, p=0.003). Overall incidence of hypotension was significantly lower in G125 (38.5% vs. 11.6%, p=0.006). Quality of analgesia and local anesthetic consumption was similar in both groups.

Conclusion: We could not demonstrate a significant difference in our primary outcome, which was the incidence of any sensory block ≥ T6. However, G125 was associated with less episodes of sensory block ≥ T6 and also with lower overall incidence of hypotension. These differences, although subtle, may be clinically relevant. Given that there is no difference in quality of analgesia, in keeping with a previous study (6), the use of a PIEB regimen with boluses delivered at 125 mL/h may be advantageous.

REFERENCES:

1. Xu J, Zhou J, Xiao H, et al. A Systematic Review and Meta-Analysis Comparing Programmed Intermittent Bolus and Continuous Infusion as the Background Infusion for Parturient-Controlled Epidural Analgesia. Sci Rep 2019; 9: 2583
2. Epsztein Kanczuk M, Barrett NM, Arzola C, et al.Programmed Intermittent Epidural Bolus for Labor Analgesia During First Stage of Labor: A Biased-Coin Up-and-Down Sequential Allocation Trial to Determine the Optimum Interval Time Between Boluses of a Fixed Volume of 10 mL of Bupivacaine 0.0625% With Fentanyl 2 μg/mL. Anesth Analg 2017; 124: 537-41
3. Zakus P, Arzola C, Bittencourt R, et al. Determination of the optimal programmed intermittent epidural bolus volume of bupivacaine 0.0625% with fentanyl 2 $\mu g.ml^{-1}$ at a fixed interval of forty minutes: a biased coin up-and-down sequential allocation trial. Anaesthesia 2018; 73: 459-65
4. Bittencourt R, Arzola C, Zakus P, et al. A biased coin up-and-down sequential allocation trial to determine the optimum programmed intermittent epidural bolus time interval between 5 mL boluses of bupivacaine 0.125% with fentanyl 2 $\mu g \cdot mL^{-1}$. Can J Anaesth 2019; 66: 1075-81
5. Cardoso MM, Carvalho JC. Epidural pressures and spread of 2% lidocaine in the epidural space: influence of volume and speed of injection of the local anesthetic solution. Reg Anesth Pain Med 1998; 23: 14-9
6. Lange EMS, Wong CA, Fitzgerald PC et al. Effect of Epidural Infusion Bolus Delivery Rate on the Duration of Labor Analgesia: A Randomized Clinical Trial. Anesthesiology 2018; 128: 745-53

Recall of Information Regarding Labour Epidurals: A Survey

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Introduction: Anesthesiologists are required to procure informed consent from women requesting labour epidural analgesia. However, at least 25% of women cannot recall a significant amount of information provided to them during informed consent.[1,2] Being appropriately informed is an important element in facilitating patient involvement in the decision making process and creating a positive birthing experience.[3,4] This is especially significant as negative birth experiences have been associated with outcomes spanning from postpartum depression to post-traumatic stress disorder.[5,6] In our academic obstetric center, informed consent is obtained verbally by the anesthesiologist prior to the provision of epidural analgesia. We plan to assess our patients' recall of the information provided and their satisfaction.

Methods: Ethics approval was obtained from the local REB, and formal written informed consent was waived. Between January and March of 2020, postpartum women within 24-48 hours from delivery were asked to participate in this survey (Figure 1). The 10-item questionnaire was created based on a review of the Canadian Medical Protective Association (CMPA) guidelines on informed consent [7] and previous studies regarding recall of information by obstetric patients.[1,8] Our primary outcome would be the degree of recall, as measured by proportion of total information provided about labour epidurals. Secondary outcomes include satisfaction with neuraxial labour analgesia, expectation of peripartum pain relief and factors influencing degree of recall and satisfaction.

Results: We aim to enrol 200 postpartum women. Preliminary results (n=95) demonstrate that 55.7% of respondents received a labour epidural in the past, and 88.4% had been given information about labour epidurals before admission. Patients reported that they received the best quality information from the obstetrician before labour started. However, the anesthesiologist became a more valuable resource during labour. While 79.7% of patients subjectively reported recalling all or most of the information provided, only 54.2% of respondents recalled 75% or more of the potential side effects discussed. 88.4% of women felt their epidurals worked as expected or better, and 87.4% were satisfied with their labour analgesia.

Conclusion: Our preliminary data seems to demonstrate that both obstetricians and anesthesiologists are valued sources of information. Perception of recall was higher than actual recall. Thus, there may be a role for the provision of written information in order to improve the understanding of risks and recall. (Final results will be presented at the conference.)

REFERENCES:

1. Brinkler R et al. Anaesth 2019;74(9):1101-1111.
2. Mahomed K et al. J Obst Gynaecol 2015;35(8):807-809.
3. Rodríguez-Almagro J, Hernández-Martínez A, Rodríguez-Almagro D, Quirós-García J, Martínez-Galiano J, Gómez-Salgado J. Women's Perceptions of Living a Traumatic Childbirth Experience and Factors Related to a Birth Experience. International Journal of Environmental Research and Public Health. 2019;16(9):1654.
4. Hodnette E. Pain and women's satisfaction with the experience of childbirth: A systematic review. American Journal of Obstetrics and Gynecology. 2002;186(5):S160-S172.
5. Ayers S, Bond R, Bertullies S, Wijma K. The aetiology of post-traumatic stress following childbirth: a meta-analysis and theoretical framework. Psychological Medicine. 2016;46(6):1121-1134.
6. Bell A, Andersson E. The birth experience and women's postnatal depression: A systematic review. Midwifery. 2016;39:112-123.
7. Evans K. CMPA - Consent: A guide for Canadian physicians. Cmpa-acpm.ca 2016. Available from: https://www.cmpa-acpm.ca/en/advice-publications/handbooks/consent-a-guide-for-canadian-physicians
8. Yurashevich M et al. Anaesth. 2019;74(9):1112-1120.

Figure 1.

Recall of Information Regarding Labour Epidurals: A Survey

1. **Have you received an epidural for labour prior to this delivery?**
   a. Yes b. No

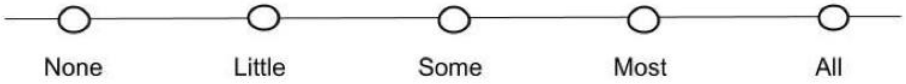
2. **Were you given information regarding epidural pain relief for this pregnancy before coming in to hospital for your delivery?**
   a. Yes b. No

3. **Who gave you information regarding epidural pain relief? (select all that apply)**
   a. Obstetrician d. Midwife g. Nurse
   b. Anesthesiologist e. Prenatal classes h. Online resources
   c. Family/friends f. Other (please expand): _____

4. **Who from the above list provided the best information?**
   a. Before labour: _____ b. During labour: _____

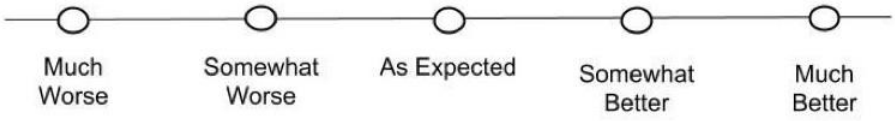
5. **Before your epidural, did the anesthesiologist explain: (Select all that apply)**
   a. The benefits c. How well it works for pain relief
   b. The risks/side effects d. Alternatives for pain relief (i.e. laughing gas)

6. **Of the information listed above, how much do you remember?**

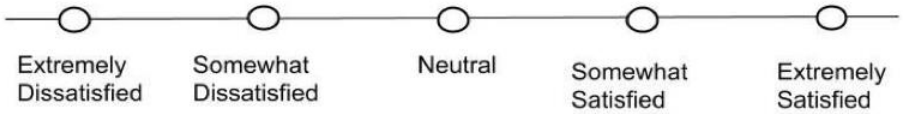


7. **Which of the following risks do you recall from your discussion with the anesthesiologist? (Select all that apply)**
   a. Headache e. Low blood pressure/high block
   b. Nerve injury f. Bleeding/bruising
   c. Infection g. Temporary leg weakness
   d. Epidural failure h. Freezing toxicity (i.e. seizures)

8. **Did the epidural work as you expected it to?**



9. **Are you satisfied with your labour analgesia?**



10. **What would help improve your satisfaction with labour analgesia?**

Sepsis in Pregnancy: Trends in Canada (SePTIC Study)

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Introduction: Maternal sepsis, characterized by dysregulated host response to infection during pregnancy, can lead to adverse outcomes in both mother and baby. There are no prior epidemiological data on maternal sepsis in Canada. The objective of this study was to evaluate the incidence, temporo-regional variation, risk factors, morbidity and mortality due to maternal sepsis in Canada.

Methods: Ethics approval was obtained from the local REB. This was a population-based retrospective cohort study based on the nationwide Discharge Abstract Database compiled by the Canadian Institute for Health Information. All delivery records (≥20 weeks gestational age) in Canada (excluding Quebec) between April 1, 2004 and March 31, 2017 and associated hospitalization information (demographics, diagnoses, therapeutic procedures) were identified using International Classification of Diseases-10CA/Canadian Classification of Interventions codes. The primary outcome was incidence of sepsis. The secondary outcomes were risk factors, morbidity (organ failure, ICU admission) and mortality. Data were summarized using descriptive statistics. Associations between risk factors and sepsis were derived using unadjusted Odds Ratios (OR).

Results: There were 4,183 cases of sepsis in 3,653,783 hospitalizations for delivery during the study period, with an incidence of 114 (95% CI: 111, 118) per 100,000 hospitalizations and a mortality rate of 0.5%. There was a trend towards decreasing sepsis rates from 2004 [160 per 100,000 (95% CI: 146, 177)] to 2016 [104 (93, 117)] ($p<0.001$). The highest sepsis rate was observed in the Territories [224 per 100,000 (95% CI: 167, 301)], while the lowest was in New Brunswick [77 (61, 98))]. Puerperal sepsis was the leading diagnostic code associated with sepsis [72%, (Table 1)]. Severe sepsis was seen in 14% (n=568) of all patients with sepsis, which we defined as patients with one or more of: septic shock (15%, n=85), organ failure (61%, n=345), ICU admission (78%, n=443) or mortality (3%, n=19). The leading systems involved in organ failure were cardiovascular (41%) and respiratory (22%). Among patients with organ failure, 30% (n=105) had multi-organ system failure. Extremes of maternal age [<25 years, OR: 1.59 (95% CI: 1.48, 1.71); >40 years, OR: 1.42 (1.22, 1.65)], multiple gestation [2.86 (2.46, 3.32)], stillbirths [8.79 (7.60,10.17)], cesarean delivery [3.32 (3.10 to 3.54)], retained products of conception [2.13 (1.69 to 2.69)], postpartum hemorrhage [3.94 (3.65 to 4.24)] and hysterectomy [24.23 (18.16, 32.32)] were associated with maternal sepsis.

Discussion: Maternal sepsis rates have been decreasing in Canada but remain higher than those observed in the UK and US.[1,2] Our study shows 1 in 8 women with sepsis develop severe sepsis-related morbidity, which warrants risk stratification, changes in practice guidelines and national preventive strategies.

REFERENCES:

1. Acosta et al. Severe Maternal Sepsis in the UK, 2011-2012: A National Case Control Study. *PLoS Med*. 2014;11:e1001672
2. Hensley et al. Incidence of Maternal Sepsis and Sepsis-Related Maternal Deaths in the United States. *JAMA*. 2019;322:890

Table 1: Morbidity and Mortality of Maternal Sepsis in Canada

Condition	N (%)	Incidence (95% CI) 100,000 hospitalizations	Organ failure N (%)	ICU Admissions N (%)	Mortality N (%)
Puerperal Sepsis	2990 (71.5)	81.8 (79.0 to 84.8)	165 (34.3)	249 (56.2)	9 (47.4)
Other Infection During Labor Includes Sepsis	683 (16.3)	18.7 (17.3 to 20.2)	43 (8.9)	48 (10.8)	2 (10.5)
Other Sepsis	441 (10.5)	12.1 (11.0 to 13.3)	139 (28.9)	154 (34.8)	10 (52.6)
Streptococcal Sepsis	136 (3.2)	3.7 (3.2 to 4.4)	21 (4.4)	23 (5.2)	0
Bacteremia	118 (2.8)	3.2 (2.7 to 3.9)	12 (2.5)	9 (2.0)	1 (5.3)
Septic Shock	85 (2.0)	2.3 (1.9 to 2.9)	85 (17.7)	69 (15.6)	4 (21.1)
Infection Following Transfusion, Infusion and Therapeutic Injection	29 (0.7)	0.8 (0.6 to 1.1)	2 (0.4)	6 (1.4)	0
Necrotizing Fascitis	23 (0.5)	0.6 (0.4 to 1.0)	6 (1.2)	16 (3.6)	1 (5.3)
Systemic Inflammatory Response with Organ Failure (Includes Severe Sepsis)	7 (0.2)	0.2 (<0.1 to 0.4)	5 (1.0)	5 (1.1)	2 (10.5)
Toxic Shock Syndrome	4 (0.1)	0.1 (<0.1 to 0.3)	3 (0.6)	2 (0.5)	0
Listerial Sepsis	4 (0.1)	0.1 (<0.1 to 0.3)	0	0	0
Infection from External Stroma of Urinary Tract	2 (<0.1)	<0.1 (<0.1 to 0.2)	0	0	0
Salmonella Sepsis	2 (<0.1)	<0.1 (<0.1 to 0.2)	0	1 (0.2)	0
Gas Gangrene	1 (<0.1)	<0.1 (0 to 0.2)	0	0	0
Hospitalizations having at least 1 Sepsis Condition	**4183**	**114.5 (111.1 to 118.0)**	**345***	**443**	**19**
Hospitalization with more than 1 Sepsis Condition	**308**	**8.4 (7.5 to 9.4)**	**107**	**115**	**7**

**345 hospitalizations with at least 1 organ failure, 481 total organ failures as 105 hospitalizations were associated with 2 or more organ failures.#*

The Effects of Height and Weight Adjusted Dose of Local Anesthetic Compared to Standard Arbitrary Dosing for Spinal Anesthesia in Elective Cesarean Delivery

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Introduction: Spinal anesthesia is a common anesthetic technique for elective cesarean delivery (CD). A challenge anesthesiologists face is selecting a dose that provides adequate anesthesia to the parturient whilst minimizing harmful side effects. Our primary concern regarding side effects is hypotension as an effect of the spinal anesthetic as it may have harmful effects to both mother and fetus.[1] Height and weight dependent dose adjustment have been studied in the past.[2] We hypothesized that a simplified dosing regimen of 0.75% hyperbaric bupivacaine would provide adequate surgical anesthesia for elective CD while decreasing the incidence of maternal hypotension and the use of vasopressors.

Methods: Ethics approval was obtained from the local REB. In this single centered, double blinded, randomized controlled trial, term parturients (n=170, ASA II, age 18-40, singleton, uncomplicated pregnancy) undergoing elective CD under spinal anesthesia were randomly allocated to receive either a fixed dose regime (1.6 mL or 12 mg 0.75% hyperbaric bupivacaine) or a height and weight adjusted dose regime (Table 1) along with fentanyl 15 mcg and preservative free morphine 100 mcg intrathecally. Systolic blood pressure of < 90 mm Hg or >25% decrease from baseline was defined as hypotension. Phenylephrine at interval doses of 100 mcg were given as needed. The primary outcome included maternal hypotension needing phenylephrine (1st line) or ephedrine (2nd line). Patient satisfaction, nausea, vomiting, pruritus, time to adequate surgical anesthesia and conversion to general anesthetic were secondary outcomes. Height and weight parameters were restricted between 150-180 cm and 50-110 kg, respectively.

Results: Characteristics between the adjusted (n=86) and fixed dose (n=84) groups were similar. The adjusted group experienced less hypotension needing statistically significant lower doses of phenylephrine (295±248 mcg vs 697±373; p 0.000) and ephedrine (1.3±3.3 vs 5.5±13.5 mg; p 0.008). The adjusted group experienced statistically significant reductions in nausea and vomiting. There was no difference in overall patient satisfaction, pruritus, and time to adequate surgical anesthesia (Table 2). In the adjusted arm, there was one conversion to general anesthesia.

Conclusion: Height and weight adjusted dose of bupivacaine provided adequate anesthesia and minimized maternal hypotension requiring vasopressor intervention. Additionally, there was significant reduction in nausea and vomiting, which are distressing side effects for the parturient.

REFERENCES:

1. Corke B.C., Datta S., Ostheimer G.W., et al. Spinal anaesthesia for Caesarean section. The influence of hypotension on neonatal outcome. Anaesthesia 1982; 37:658-62.
2. Harten J.M., Boyne I, Hannah P. et al. Effects of a height and weight adjusted dose of local anaesthetic for spinal anaesthesia for elective Caesarean Section. Anaesthesia. 2005; 60:348-353.

Table 1: Height and Weight Adjusted 0.75% Hyperbaric bupivacaine; shown in volume

Height (cm)	150	155	160	165	170	175	180
Weight (kg)							
50	1.2	1.3					
60	1.1	1.2	1.3	1.4			
70	1.1	1.1	1.3	1.3	1.4	1.5	
80			1.2	1.3	1.4	1.5	1.6
90			1.1	1.3	1.3	1.4	1.5
100			1.1	1.2	1.3	1.4	1.5
110				1.1	1.2	1.3	1.5

Table 2: Primary and Secondary Outcomes Data

	Fixed Dose Group (n=84)	Adjusted Dose Group (n=86)	95% CI: lower, upper	P value
Primary Outcome				
Phenylephrine (mcg)	697 (373)	295 (248)	306, 497	0.000
Ephedrine (mg)	5.45 (13.48)	1.31 (3.32)	1, 7	0.008
Secondary Outcomes				
Nausea (yes)	46	27		0.002
Vomiting (yes)	4	0		0.041
Pruritus (yes)	13	14		0.913
Patient Satisfaction D/N/S/CS	0/1/33/49	2/4/31/49		0.282

D/N/S/CS – Dissatisfied/Neutral/Satisfied/Completely Satisfied