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(Abstracts and Case Report/Series)

Contents

A Novel Cognitive Aid for Management of Cardiac Arrest in a Coronavirus Disease 2019 (COVID-19) Positive or Suspected Parturient

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Introduction: Cardiac arrest in a parturient is a rare and challenging clinical scenario, requiring multi-disciplinary involvement and coordination. The American Heart Association (AHA) guidelines suggest immediate perimortem caesarean delivery (PMCD) to facilitate maternal resuscitation if there is no revival by 5 minutes[1]. The COVID-19 pandemic has added another layer of complexity with the need for protected code blue and safe airway management, which delay the intervention. The aim of this quality improvement (QI) study is to incorporate critical tasks from the protected code blue and COVID-19 airway management protocols to design a new cognitive aid for safe and efficient management of maternal cardiac arrest in a COVID-19 positive or suspected parturient.

Methods: As a QI initiative, ethical review was waived by local REB. The checklist was drafted through a brainstorming session with anesthesiologists, anesthesia residents, obstetric clinical educators, and maternal intensive care unit (WHICU) physician to compile elements from the AHA maternal cardiac arrest algorithm[1,2], the protected code blue algorithm and recommendations for COVID-19 airway management[3]. We performed a pilot simulation to assess the practicality of the checklist for PMCD. Next, an in-situ high-fidelity simulation in the WHICU involving multidisciplinary members of the code blue team was conducted to assess the workflow and modify the checklist based on participants' feedback. The updated checklist was circulated to 6 anesthesiologists and 2 obstetric clinical educators to rate each item between 0-4, where 0 meant the item is not important and 4 is very important to patient management. A final cognitive aid was prepared after two rounds of modified Delphi process of consensus generation.

Results: The in-situ simulation revealed that the time to PMCD using the draft cognitive aid was 13 minutes, signifying a need to increase efficiency. Our survey responses indicated a consensus among raters (100%) regarding the priority to call for help from the anesthesiologist, obstetrician, and neonatal team; and the need for essential equipment such as video-laryngoscope, PMCD set, and neonatal resuscitation equipment. Full PPE and high-quality CPR were also highlighted by 100% of raters as being critical checklist components. Items rated by the majority as unimportant were removed from the algorithm to improve efficiency. For example, pre-oxygenation and clamping of endotracheal tube were not considered important steps of the algorithm as indicated by 62.5% and 75% of participants, respectively.

Discussion: The cognitive aid facilitates safety of the responders while promoting early call for help and resuscitation of the parturient (figure 1). There is enhanced focus on airway management to promote oxygenation of the patient while maintaining airborne precautions. This aid can be potentially utilized for any maternal cardiac arrest scenario requiring airborne precautions. Further simulations will be performed to assess and enhance the efficiency of the cognitive aid.

REFERENCES:

1. Lavonas, E. J. (2020). Highlights of the 2020 American Heart Association's Guidelines for CPR and ECC. American Heart Association.
2. Jeejeebhoy, F. M., et al. (2015). Cardiac arrest in pregnancy. *Circulation*, 132(18), 1747-1773. doi:10.1161/cir.0000000000000300.
3. Adult Protected Code Blue. (2020). Hamilton, Ontario: HHS Corporate Code Blue Committee.

Figure 1. Cognitive Aid for Management of Cardiac Arrest in a Positive or Suspected COVID-19 Parturient

First Responder	☐ Don PPE (surgical mask, face shield, gown, gloves) ☐ Check for pulse ☐ Activate code blue/call for help: OB, Anesthesia, NICU, RT ☐ Crash cart/maternal airway equipment/video-laryngoscope/PMCD set/neonatal resuscitation equipment/portable PPE cart	
Code Team Arrival	☐ Don PPE before entering room (N95, face shield, gown, gloves) ☐ Donning buddy present	
Circulation	**Pulse present** ☐ 100% O2 non-rebreather mask with filter ☐ Head tilt-chin lift ☐ No BMV ☐ Manual left uterine displacement ☐ IV access (above diaphragm)	**Pulse absent** ☐ High quality chest compression ☐ Manual left uterine displacement ☐ AED applied ☐ If rhythm shockable → shock, resume CPR ☐ If unshockable rhythm → Continue CPR ☐ IV access/other ACLS interventions (e.g. epinephrine)
Airway	☐ Hold CPR for intubation ☐ No BMV ☐ If BMV required, two operators required for tight seal and use low tidal volume ☐ Intubate with video-laryngoscope ☐ Inflate cuff ☐ Attach HEPA filter to ETT ☐ Connect to Ambu bag ☐ EtCO2 confirmation ☐ Resume CPR ☐ Firmly secure tube with tape ☐ Tape to prevent accidental disconnection of tube and HEPA filter ☐ Failed intubation attempt--Go to plan B or C ☐ A separate bin or plastic bag to throw used airway, stylet etc.	
Delivery/Differentials	☐ Consider differentials ☐ OB decision for perimortem cesarean delivery within 5 min if unable to obtain ROSC ☐ Baby handed over to NICU team ☐ Continue CPR and ACLS ☐ Transfer patient to OR/ICU	
Doffing	☐ Doffing of PPE ☐ Doffing buddy present	

PPE = Personal protective equipment; OB = obstetrics; NICU = neonatal intensive care unit; PMCD = perimortem caesarean delivery; BMV = Bag mask ventilation; AED = automated external defibrillator; CPR = Cardiopulmonary resuscitation; ACLS = Advanced Cardiovascular Life Support, ETT = endotracheal tube; EtCO2= End-tidal Carbon Dioxide; HEPA = High-Efficiency Particulate Air; ROSC= Return of Spontaneous Circulation; OR= Operating Room.

Carbetocin Versus Oxytocin Following Vaginal and Cesarean Delivery: A Before-After Study

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Introduction: Oxytocin is the routine postpartum uterotonic at our institution. A nationwide shortage of oxytocin resulted in an abrupt temporary switch from oxytocin to carbetocin for all postpartum patients at our institution. This temporary change in practice offered a unique opportunity to conduct a pragmatic comparative assessment of the efficacy of oxytocin and carbetocin to prevent postpartum hemorrhage.

Methods: Ethics approval was obtained from the local REB. This was a retrospective before-after study. Medical records from 641 and 752 women were retrospectively reviewed and included in the analysis in the carbetocin and oxytocin groups respectively. The standard carbetocin dosing was 100 mcg intravenous bolus following vaginal deliveries and intrapartum cesarean deliveries, while for elective cesarean deliveries it was 50 mcg intravenous bolus, with an additional 50 mcg bolus used if required. The standard oxytocin dosing was 5 IU intravenous bolus followed by 20 IU/L maintenance at a rate of 120 ml/hour for 4-6 hours following vaginal delivery, while for cesarean delivery it was 1-3 IU boluses, 3 minutes apart, up to 10 IU if required, followed by 20 IU/L maintenance infusion at a rate of 120 ml/hour. In all patients, if uterine tone was suboptimal, the maintenance solution could be changed to 40 IU/L with the same infusion rate, and additional uterotonics (ergot, carboprost, mysoprostol) were used as appropriate. Outcomes of interest were the need for additional uterotonics, estimated blood loss and calculated blood loss (only for cesarean deliveries), the occurrence of postpartum hemorrhage and the need for blood transfusion.

Results: The incidence of postpartum hemorrhage was higher in the carbetocin group compared to the oxytocin group (10.3% versus 6.6% respectively, p=0.01). More women in the carbetocin group required additional uterotonic drugs as compared to those in the oxytocin group (12% versus 8.8%, respectively, p=0.05). In addition, more women in the carbetocin group required blood transfusion as compared to those in the oxytocin group (1.4% versus 0.3% respectively, p=0.02).

Discussion: Oxytocin is superior to carbetocin for both vaginal and cesarean deliveries when used according to our institutional protocol.

REFERENCES:

1. Danserau J et al. Double-blind comparison of carbetocin versus oxytocin in prevention of uterine atony after cesarean section. Am J Obstet Gynecol 1999; 180:670-6
2. Whigham CA et al. Carbetocin versus oxytocin to reduce additional uterotonic use at non-elective caesarean section. J Matern Fetal Neonatal Med 2016; 29:3866-9
3. Gallos I et al. Uterotonic agents for preventing postpartum haemorrhage: a network meta-analysis. Cochrane Database Syst Rev. 2018 Apr5; 4(4):CD011689

Obstetric outcomes in the carbetocin and oxytocin groups

	Oxytocin N=752	Carbetocin N=641	p
Vaginal Cesarean section	503 (66.9) 249 (33.1)	369 (57.6) 272 (42.4)	<0.01
Vaginal Spontaneous Assisted	 417 (55.5) 86 (11.4)	 288 (44.9) 81 (12.6)	 0.07
Cesarean section Elective In labor	 142 (18.9) 107 (14.2)	 159 (24.8) 113 (17.6)	 0.74
EBL (by physician), ml Vaginal Elective CS In labor CS	 298 (149) 661 (184) 716 (213)	 332 (172) 677 (197) 745 (259)	 <0.01 0.49 0.37
EBL (calculated), ml Elective CS In labor CS	 992 (563) 1153 (621)	 865 (560) 1230 (588)	 0.07 0.37
Primary PPH diagnosis	50 (6.6)	66 (10.3)	0.01
Blood Transfusion	2 (0.3)	9 (1.4)	0.02
Use of 2nd uterotonic	66 (8.8)	77 (12.0)	0.05

Numbers are N (%) and mean (SD); EBL: estimated blood loss;

PPH: postpartum hemorrhage; CS: cesarean section

Carbetocin vs Oxytocin at Elective Cesarean Deliveries: A Double-Blind, Randomized Controlled Non-Inferiority Trial of High and Low Dose Regimens

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Introduction: Oxytocin or carbetocin are recommended for routine administration after delivery of the fetus during cesarean delivery (CD) to prevent post-partum hemorrhage (PPH) [1]. Traditionally, higher doses of these drugs have been used. However, there is increasing evidence that lower doses may be as effective and produce less side effects [2-4]. We sought to compare the effect of (i) low and high dose oxytocin, and (ii) low and high dose carbetocin on uterine tone at elective CD. Our hypothesis was that the low dose (LD) would be non-inferior to the high dose (HD) for both drugs.

Methods: Ethics approval was obtained from the local REB. We included ASA 2-3 women with no risk factors for PPH undergoing elective CD under spinal anesthesia. Women were randomized into 4 groups: (OxyLD) oxytocin 0.5IU bolus + infusion of 40 mIU/min for 8 hours; (OxyHD) oxytocin 5IU bolus + infusion of 40mIU/min for 8 hours; (CarLD) carbetocin 20µg + placebo infusion; (CarHD) carbetocin 100µg + placebo infusion. The study drug was given as a slow IV bolus after delivery of the fetus. The obstetrician was asked to assess uterine tone intensity at 2,5 and 10 minutes after administration of the study drug using a verbal numerical rating scale (VNRS) of 0-10. The primary outcome was uterine tone 2 minutes after study drug administration. The pre-specified non-inferiority margin was 1.2 points on the 11 point scale. Secondary outcomes were uterine tone after 5 and 10 minutes, use of additional uterotonics, blood loss and side effects.

Results: We included 277 women in the analysis. Results for the primary outcome and some secondary outcomes are shown in Table 1. The mean (SD) uterine tone at 2 minutes was similar across all groups, with OxyLD being non-inferior to OxyHD and CarLD being non-inferior to CarHD : 7.1 (1.4) and 7.3 (1.9) for OxyLD and OxyHD: difference (95% CI) -0.20 (-0.76, 0.36); 7.4 (1.7) and 7.6 (1.5) for CarLD and CarHD: -0.18 (-0.71, 0.36). As a secondary analysis comparing the four groups, no significant difference was observed for the primary outcome. Uterine tone at 5 and 10 minutes was non-inferior when OxyLD and CarLD were compared to OxyHD and CarHD respectively. Use of additional uterotonics, blood loss and side effects were similar across all groups.

Discussion: At elective cesarean delivery, the uterine tone determined by low dose oxytocin (0.5IU) is non-inferior to that determined by high dose oxytocin (5IU); similarly, the uterine tone determined by low dose carbetocin (20µg) is non-inferior to that determined by high dose

carbetocin (100µg). Low dose and high dose regimens of both oxytocin and carbetocin seem to be associated with similar need for additional uterotonic drugs, blood loss, and similar side effects.

REFERENCES:

1. Heesen et al. Anaesthesia 2019; 74:1305-1319
2. Carvalho et al. Obstet Gynecol 2004; 104:1005-1010
3. Khan et al. Can J Anesth 2014; 61:242-248
4. Tabl et al. Anaesthesia 2019; 74:190–196

Table 1. Carbetocin vs oxytocin at elective cesarean deliveries: results for the primary outcome and some secondary outcomes

	Oxytocin 0.5IU N=69	Oxytocin 5IU N=69	Carbetocin 20mcg N=70	Carbetocin 100mcg N=69	p-value
Uterine tone, mean (SD)					
2 min	7.1 (1.4)	7.3 (1.9)	7.4 (1.7)	7.6 (1.5)	0.33
5 min	7.4 (1.4)	8 (1.5)	7.8 (1.2)	7.9 (1.3)	0.049
10 min	7.9 (1.4)	8 (1.5)	8 (1.4)	8.3 (1.5)	0.35
Additional uterotonics intraoperatively, N(%)	17 (24.6)	11 (15.9)	11 (15.7)	12 (17.4)	0.48
Additional uterotonics in 1st 24 hours post-op, N(%)	7 (10.1)	5 (7.3)	4 (5.7)	2 (2.9)	0.37
Blood Loss, median (IQR)	777 (492,1090)	829 (502,1169)	844 (502,1163)	887 (484,1186)	0.83

Evaluating the Effect of a Quality Improvement Bundle to Reduce Opioid Prescriptions After Cesarean Delivery

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Introduction: The United States and Canada are the first and second-largest per capita consumers of opioids worldwide.[1] Health Quality Ontario has emphasized that there is an immediate need to integrate quality improvement plans for post-operative prescribing of opioid pain medication.[2] It has been established that cesarean delivery is the most commonly performed inpatient surgery in Canada and the United States.[3] Numerous studies have shown that post-cesarean delivery opioid prescriptions are routinely provided at discharge in large excess.[4,5] The objective of this study is to evaluate whether there has been a decrease in opioid prescriptions at discharge after cesarean delivery following a quality improvement bundle.

Methods: Ethics approval was obtained from the local REB. A quality improvement bundle was instituted in a large Canadian tertiary academic centre. Interventions included (1) resident education, (2) postpartum nursing education, (3) posters, (4) patient educational materials, and (5) electronic discharge prescriptions. We used retrospective cohort study design and included all patients who had a cesarean delivery six months pre-intervention and post-intervention. For the primary outcome, linear regression was used to compare the amount of opioids prescribed at discharge in both periods, while allowing for temporal effects and controlling for confounding variables. Secondary outcomes were assessed using bivariate methods and included whether opioids were used for breakthrough pain in-hospital, and the amount of opioids prescribed by prescriber program and level of training.

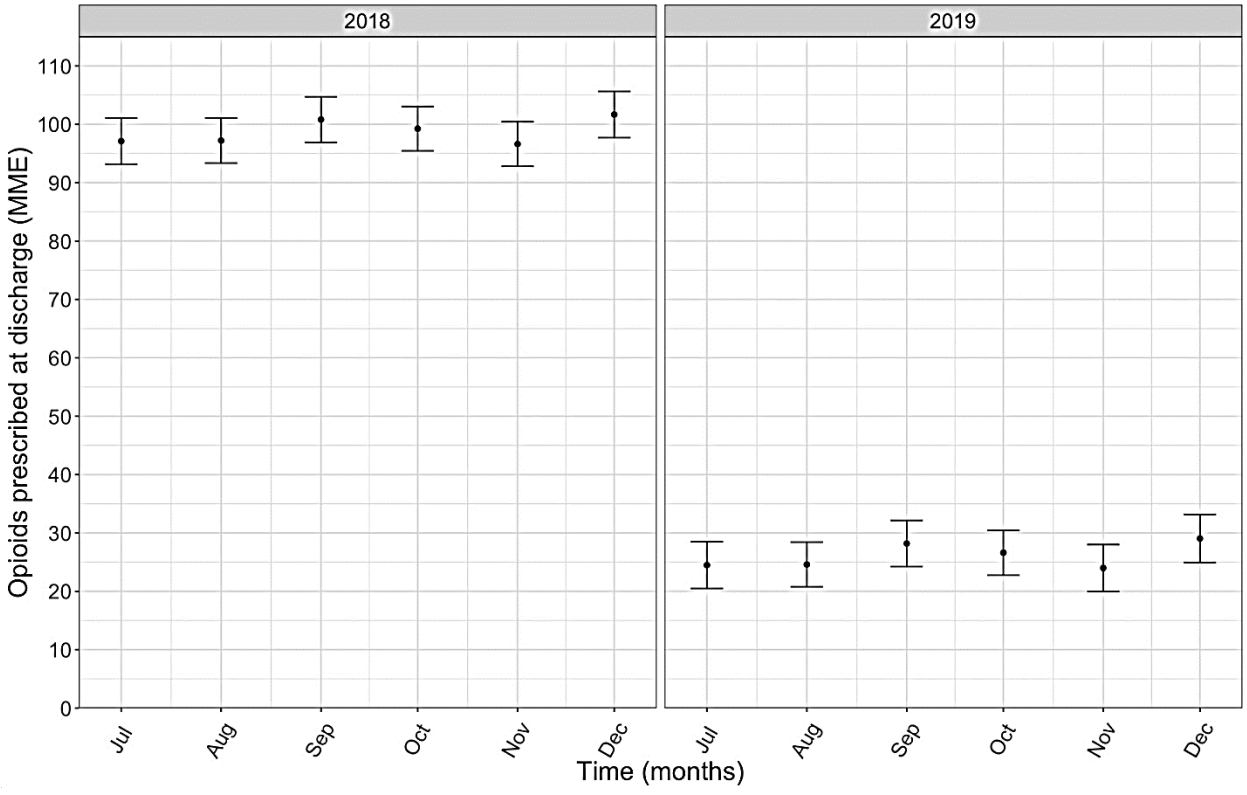
Results: 2,578 women were included in our analysis. Based on the multiple regression analysis, opioid prescribing decreased from 95.6 morphine milliequivalents (MME) in 2018 (95% CI 82.8 - 108.5) to 23.0 MME in 2019 (95% CI 10.2 - 35.8), (P<.001) which was sustained over the study period. Post-intervention, opioid prescriptions were significantly reduced in those who did not require opioids in-hospital (41.1%) compared to those who did (74.8%) (P<.001). In both the pre-intervention and post-intervention groups, prescriber level of training made a significant difference in amount of opioid prescribed at discharge (P<.001). Attending physicians prescribed the most pre-intervention and post-intervention. Prescriber training program was associated with a change in opioids prescribed post-intervention (P=.002) but not pre-intervention. Prescribers from obstetrical and radiology programs were found to prescribe the most. Obstetricians were asked if there were extra visits or phone calls postpartum regarding pain management and no change was reported.

Discussion: A quality improvement bundle led to a dramatic sustained decrease in discharge prescriptions of opioids post-cesarean delivery at a large Canadian tertiary academic hospital.

The ongoing opioid crisis in North America highlights the need for continued evaluation of and education about best prescribing practices. We recommend that similar interventions be implemented and assessed across Canada and the United States in obstetrical units and in other clinical settings such as inpatient surgery.

REFERENCES:

1. Canadian Institute for Health Information. Opioid Prescribing in Canada: How Are Practices Changing? (2019). Available at: https://www.cihi.ca/sites/default/files/document/opioid-prescribing-canada-trends-en-web.pdf. (Accessed: 20th January 2021)
2. Health Quality Ontario. Recommendations for Adoption: Opioid Prescribing for Acute Pain. Available at: http://www.hqontario.ca/Portals/0/documents/evidence/quality-standards/qs-opioid-acute-pain-recommendations-for-adoption-en.pdf. (Accessed: 20th January 2021)
3. McDermott, KW., Freeman, WJ., Elixhauser, A. Most Common Operations in Hospital Inpatient Stays - HCUP Fast Stats. Available at: https://www.hcup-us.ahrq.gov/faststats/NationalProceduresServlet. (Accessed: 20th January 2021)
4. Gold, S., Figueiro-Filho, E., Agrawal, S. & Selk, A. Reducing the Number of Opioids Consumed After Discharge Following Elective Cesarean Delivery: A Randomized Controlled Trial. J. Obstet. Gynaecol. Canada (2020). doi:10.1016/j.jogc.2020.02.123
5. Mehraban, S. S. et al. Opioid-free multimodal analgesia pathway to decrease opioid utilization after cesarean delivery. J. Obstet. Gynaecol. Res. jog.14582 (2020). doi:10.1111/jog.14582



Management of Laryngeal Sarcoidosis During Pregnancy

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Introduction: Sarcoidosis is a chronic inflammatory disease which occurs in genetically susceptible individuals and is characterized by an exaggerated immune response to foreign substances. This response results in the formation of granulomas in various organs, typically lung, skin, and lymph nodes. The estimated incidence of sarcoidosis varies greatly according to the region and is 17.8 per 100,000 per year among African-Americans and 7.6-8.8 cases per 100,000 per year in the USA. Isolated laryngeal sarcoidosis (ILS) is extremely rare and occurs in only 0.8-5% of all sarcoid patients. ILS can further alter the anatomy of the pregnant airway and pose challenges for emergent airway intervention.

Case discussion: Patient consent was obtained for publication of this case. A 40yr old G4P3L3 female was scheduled for induction of labour at 38 weeks and 1 day. At 26 weeks gestation she a reported fullness sensation in her throat, dry cough, and inability to clear secretions. Maternal-foetal medicine service coordinated multidisciplinary care and arranged consultations with anesthesiology and otolaryngology. Laryngoscopy was performed and showed widespread lesions but no evidence of airway compromise. Systemic steroid therapy was initiated with prednisone, 50 mg. PO. daily. Originally diagnosed with ILS in 2010, she subsequently underwent three debulking surgeries in 2014,2016 and 2018. Co-morbidities complicating the current pregnancy included: morbid obesity (BMI 55), OSA (CPAP non-compliant), and gestational diabetes mellitus. Foetal macrosomia was identified on ultrasound.

Shortly after admission to the high-risk obstetrical unit, reliable intravenous access was established. An epidural catheter was inserted immediately after the initiation of oxytocin. The epidural was placed with aid of ultrasound guidance. The dural puncture technique was employed mainly to avoid false loss of resistance and subsequent mal-placement of the catheter. Finally, the patient's spine was extended prior to fixing the catheter to prevent its migration. Good labour analgesia was achieved.

During cervical exam to assess for artificial rupture of membranes, the obstetrical team discovered that the baby had verted to breech position. Urgent caesarean section was undertaken. Although the epidural appeared to be working well, an approach to secure the airway was also meticulously planned. Adequate anaesthesia was successfully achieved using the epidural catheter. Delivery was uneventful. The catheter was left in place for postoperative analgesia. The patient was discharged from the operating room to a high-dependency unit ("step-down") where she remained for one day. After an uneventful 24 hours, she was then discharged to a post-partum unit.

Conclusion: To date, there are no published reports of ILS in a pregnant woman. Accordingly, optimal anaesthetic management in the peripartum period has not been described. In this case, the care team relied on early preoperative consultation, patient education, and multidisciplinary planning to optimize the outcome of labour and delivery in a patient with this rare condition.

REFERENCES:

1. Arkema EV, Cozier YC. Epidemiology of sarcoidosis: current findings and future directions. *Ther Adv Chronic Dis*. 2018;9(11):227-240. Published 2018 Aug 24. doi:10.1177/2040622318790197
2. Dean CM, Sataloff RT, Hawkshaw MJ, Pribikin E. Laryngeal sarcoidosis. J Voice. 2002 Jun;16(2):283-8. doi: 10.1016/s0892-1997(02)00099-1. PMID: 12150382.

Obstetric and Anesthetic Management of Deliveries in Women with Fontan Circulations: Single Centre Experience and Trends in Practice Over the Past 21 Years

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Introduction/Background: The Fontan procedure is undertaken in infants with a single functional ventricle. In a staged fashion over childhood the systemic venous return is routed to the pulmonary arteries without the interposition of a ventricle(1). Currently the estimated 20-year survival of these patients is 61% to 85%(2). Improvements in care means that survival rates are predicted to improve further. Obstetric anesthetists will increasingly be involved in the management of these women. The limitations of the Fontan circulation means that the physiological burdens of pregnancy can pose a significant health risk to these women(3, 4). We sought to examine the anesthetic management and complications suffered by these women during delivery.

Methods: Ethics approval was obtained fron the local REB. We reviewed the medical records of women with Fontan circulation who delivered at our institution, from 2000 to 2020. A register of these women is maintained by the High Risk Obstetric team. We extracted data related to co-morbidities, underlying cardiac functional status, anesthetic management, mode of delivery and peripartum complications.

Results: Over 21 years there were a total of 28 deliveries to 20 women. 20 of these deliveries occurred since 2010. There were no deaths. One woman had three deliveries over 15 years and there was one twin delivery. The functional status of these women pre-pregnancy was good. The average maternal age at delivery was 27.7 years. The average gestation at delivery was 34 weeks. 19 deliveries were vaginal and 9 were by cesarean section. 16 of the vaginal deliveries had epidurals. Of the 9 deliveries by cesarean section 6 had epidural anesthesia, 1 had spinal anesthesia, 1 had a combined spinal-epidural and 1 had continuous spinal anesthesia. Central line insertion for delivery was not performed after 2004. After 2012, 75% of eligible vaginal deliveries did not have arterial lines. Postpartum care on the obstetric floor as opposed to CCU also became more common (74%) after 2006. Complications were frequent, particularly arrythmias (18%), with just 10 of 28 deliveries having no recorded complications.

Discussion: This is the largest published case series describing the anesthetic management of women with Fontan circulation. It is noteworthy that 20 of these deliveries occurred since 2010. Reassuringly there were no deaths in our series. Increasing familiarity in managing these complex patients is reflected in the trend of reduced invasive vascular access use and post partum care on the obstetric floor. However we should not be complacent as complications were frequent, particularly arrythmias. Multi-disciplinary care by anesthetists, obstetricians and cardiologists is the hidden narrative underpinning the care provided to these women.

REFERENCES:

1. Gewillig M, Brown SC. The Fontan circulation after 45 years: update in physiology. Heart. 2016;102(14):1081-6.

2. Rychik J, Atz AM, Celermajer DS, Deal BJ, Gatzoulis MA, Gewillig MH, et al. Evaluation and Management of the Child and Adult With Fontan Circulation: A Scientific Statement From the American Heart Association. Circulation. 2019:CIR0000000000000696.
3. Garcia Ropero A, Baskar S, Roos Hesselink JW, Girnius A, Zentner D, Swan L, et al. Pregnancy in Women With a Fontan Circulation: A Systematic Review of the Literature. Circ Cardiovasc Qual Outcomes. 2018;11(5):e004575.
4. Monteiro RS, Dob DP, Cauldwell MR, Gatzoulis MA. Anaesthetic management of parturients with univentricular congenital heart disease and the Fontan operation. Int J Obstet Anesth. 2016;28:83-91.