

Abstract

A parturient with von Willebrand's Disease, type 2b and inadvertent preoperative iatrogenic fluid overload underwent cesarean section under general anesthesia. Shortly after delivery, hypoxemia, diffuse rales and wheezing developed. Electrical Cardiometry, a new method for measuring hemodynamics non-invasively, demonstrated decreased stroke and cardiac indices, corroborating a diagnosis of acute left ventricular failure. The patient was diuresed and her clinical picture and hemodynamic parameters improved. Electrical Cardiometry is a promising non-invasive technology for estimating stroke volume and cardiac output in an awake parturient.

Case Report

A 28 y.o. woman, G3P1, presented at 38-2/7 weeks e.g.a. with vaginal bleeding. She had had a primary cesarean section four years earlier for macrosomia, received 14 units of blood for post partum hemorrhage and was diagnosed with von Willebrand's Disease type 2b. Prior to this current admission, PT, INR, Factor 8 and vWF antigen were normal, PTT and Ivy Bleeding Time were prolonged at 43.1 sec and greater than 20 minutes, respectively, and vWF activity was low at 18% of normal.

Platelet count on this admission was 26K, with abundant platelet clumping seen on peripheral smear. The hematologist suggested that in vivo platelet number might be normal. The patient received Humate 6000 U, after which the vWF activity normalized. The decision was made to proceed with cesarean section. General anesthesia was planned because of the low platelet count and the history of hemorrhage. Physical examination was unremarkable.

A second IV was placed and during three hours prior to surgery the patient inadvertently received 3 L of Lactated Ringers solution. Despite this excessive fluid administration, the patient's lungs were clear to auscultation, she did not complain of any respiratory distress and her oxygen saturation on room air was 97%. Cefazolin 2 gm was administered and no rash or respiratory symptoms were noted at that time. In addition to routine monitors, the Aesculon electrical velocimetry system (Cardiotronic, Inc. Jolla, California) was applied.

General anesthesia and muscle relaxation were induced with propofol 200 mg IV and succinylcholine 140 mg IV and the trachea was intubated at 1325, with the tube at a depth of 18 cm at the teeth. Auscultation revealed normal breath sounds bilaterally and SpO2 was 100%. Anesthesia was maintained with N2O 50% in oxygen and sevoflurane 1% inspired until a female infant was born with Apgars of 6 and 9 at 1330. After delivery a bolus of oxytocin 2 U was given followed by a rapid infusion of 40 U/L. N2O was increased to 70%, the sevoflurane was reduced to 0.2% inspired and fentanyl 100 mcgm and midazolam 2 mg were administered.

Six minutes after delivery (1336) the patient began to "buck" on the endotracheal tube and the surgeon requested more relaxation. The chest was uncovered to better observe chest movement and a blanching rash was noted. Also, the SpO2 had decreased from 100% to about 85%. Blood pressure was 150/90. Vecuronium 3 mg, propofol 80 mg and fentanyl 100 mcgm were administered to deepen anesthesia and facilitate both surgery and ventilation. Auscultation of the lungs revealed diffuse, bilateral rales and wheezing. 100% oxygen was administered and the patient was ventilated by hand with PEEP. Albuterol was administered into the endotracheal tube because of a provisional diagnosis of bronchospasm.

To further deepen anesthesia and provide bronchodilation, the sevoflurane was briefly increased to 3% inspired and then decreased to 1%. The trachea was suctioned for modest amounts of clear secretions.

At this time it was noted that the nominal cardiac index (nCI) and nominal stroke index (nSI) had decreased from pre-delivery levels, as shown in Figure 1. This fact, together with the timing of the hypoxemia and our knowledge of the previous administration of a large amount of IV fluid, led to the tentative diagnosis of acute heart failure, precipitated by autotransfusion and relief of vena caval compression at delivery. The patient received furosemide 40 mg IV at approximately 1342 and brisk diuresis ensued. The fiberoptic bronchoscope revealed that the tip of the endotracheal tube was 4 cm above the carina and that despite copious watery secretions, there were no mucus plugs or foreign bodies in the airway. Thereafter, hemodynamic parameters appeared to improve in step with the clinical picture as diuresis continued.

By the end of surgery at 1455, the lungs were clear and the SpO2 was 100%. The patient was extubated and recovered uneventfully. During surgery hemostasis was normal. EBL was 850 mL. By the end of the procedure the rash on the chest had disappeared.

Conclusion

Electrical Cardiometry, a new method for measuring hemodynamics non-invasively, demonstrated that acute hypoxemia, wheezing and rales after cesarean delivery under general anesthesia were associated with decreased stroke and cardiac indices. This observation corroborated the tentative diagnosis of acute left ventricular failure. The patient's clinical condition and hemodynamic parameters normalized after deepening anesthesia and diuresis. Electrical Cardiometry offers promise as a non-invasive means of estimating stroke volume and cardiac output.

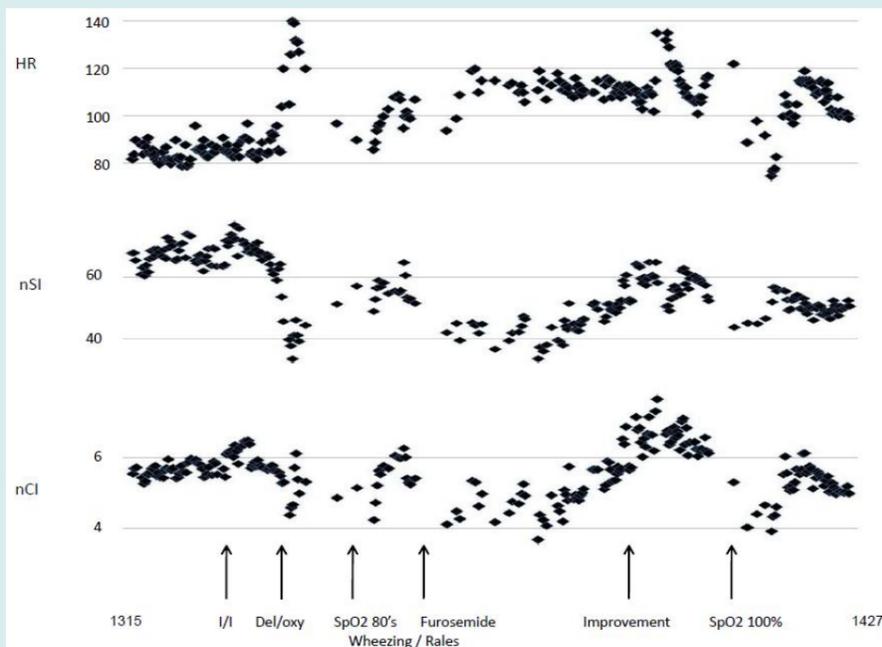


Figure 1. Intubation and incision (I/I) at 1325 are followed by delivery and oxytocin administration (Del/oxy) at 1330. At 1336 hypoxemia, wheezing and rales develop, associated with decreased stroke and cardiac indices, suggesting left ventricular failure. Furosemide at 1342 is followed by diuresis, clinical improvement and increased stroke and cardiac indices. nSI = nominal stroke index, nCI = nominal cardiac index.

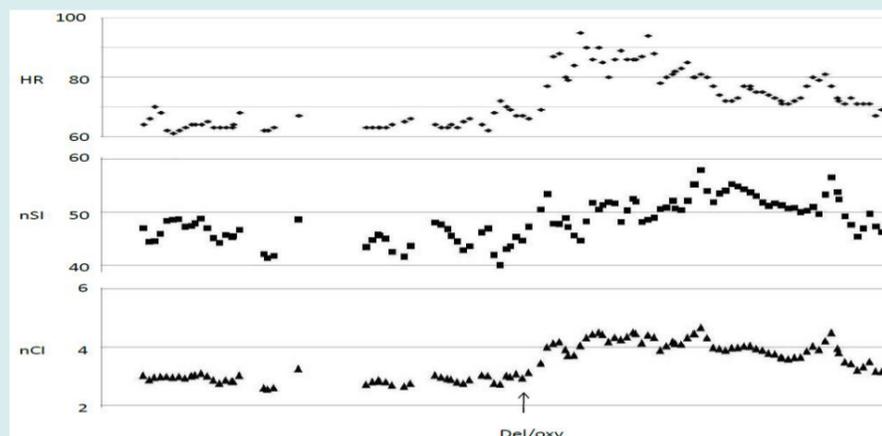
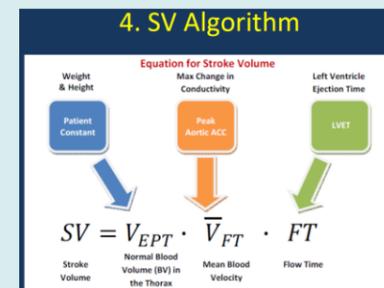
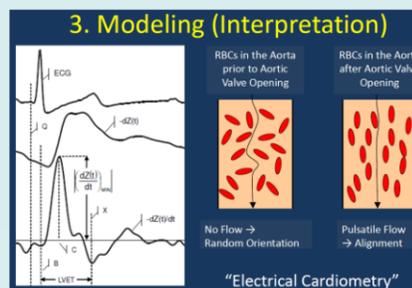
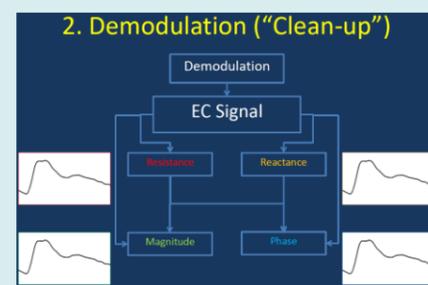
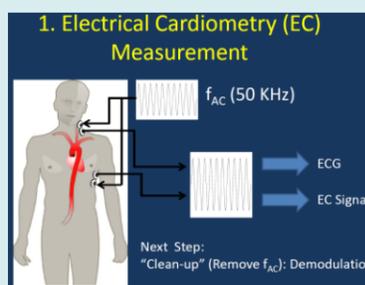


Figure 2. Example of normal hemodynamics at delivery under spinal anesthesia (1) (not case reported in poster). Delivery and oxytocin 5 U bolus (Del/oxy) are followed by increased heart rate and nominal stroke and cardiac indices. 20 minutes of data shown.



Four slides courtesy of Cardiotronic, Inc.

Reference (1): Archer TL, Conrad BE, Tarsa M, Suresh P. Electrical velocimetry demonstrates the increase in cardiac output and decrease in systemic vascular resistance accompanying cesarean delivery and oxytocin administration. J Clin Anesth. Accepted for publication November 25, 2010.