

## ECMO Support Following Cesarean Section from H1N1 in the SICU

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### ABSTRACT

This article presents the case of a pregnant woman affected by H1N1 influenza that progressed to VV-ECMO. The mother at the time was pregnant with a viable infant of which the Cesarean section was performed prior to her going on ECMO. The infant was delivered and had an expected course in the NICU, while the mother remained on ECMO for 5 days prior to her being weaned from ECMO. She was later discharged to the rehab unit and then to home. The mother's greatest complications include continued pleural effusions, generalized weakness and peroneal neuropathy.

### BACKGROUND

In 2009, H1N1 caused significant morbidity and mortality, which was mostly seen in the younger age groups and pregnant women, but lower in the elderly population.<sup>1</sup> The virus was noted to have a short prodromal phase quickly followed by respiratory failure.<sup>2</sup> Specifically, pregnant women might be at increased risk for complications from pandemic H1N1 virus infection.<sup>3</sup> It is likely that changes in cardiac, immune, and respiratory systems during pregnancy put these patients at increased risk for severe illness.<sup>4</sup> A study by the CDC during the first month of the US H1N1 outbreak showed that hospital admission rates for pregnant women were 4 times higher than that of the population.<sup>3</sup> Another study in JAMA showed that pregnant women had a disproportionately high risk of mortality in which early antiviral treatment appeared to be associated with fewer admissions to the ICU and fewer deaths. In addition, among the women who died, 7.1% did so in the first trimester, 26.8% in the second and 64.3% in the third.<sup>5</sup> Unfortunately, this virus may not be recognized early enough that the patients will have time to receive treatment. So, other therapies and treatments must be used to symptomatically treat the patient until they can recover.

The use of ARDS treatment with the conventional ventilator and subsequent use of extracorporeal membrane oxygenation (ECMO) is well studied in the literature.<sup>6</sup> There are numerous articles in which ECMO is used for respiratory failure in pregnant patients.<sup>7,8,9,10,11,12</sup> Of these reports, two of the patients were placed on ECMO, recovered from ECMO and later delivered a fetus.<sup>11,12</sup> In one case, a mother spontaneously delivered a 24 week infant after being on ECMO for 30 hours.<sup>9</sup> In another case report, the mother was placed on ECMO for 8 weeks and the child was delivered by cesarean section at 30 weeks after mother was on ECMO for 5 weeks.<sup>7</sup> The final case report discusses a mother who was placed on ECMO and spontaneously aborted the fetus after being on ECMO for 7 days and she unfortunately succumbed to her illness on day 28 of ECMO cannulation.<sup>12</sup>

This case presents issues of a pregnant patient with a viable fetus in respiratory failure and the team effort that led to the successful delivery of the fetus and lifesaving assistance, which allowed the mother to recover.

### CASE REPORT

#### Mother Hospital Course

28 year old G3P2002 female, who was at 28.6 weeks gestational age, when she was transferred

from an outside hospital in rural Colorado, presented with respiratory failure. She reported that she was starting to feel short of breath a couple of days prior to arrival at that hospital and she had thought that it was an asthma exacerbation. Over the next couple of days, she started having increasing work of breathing and required oxygen. Once she had been increased to 40% FiO<sub>2</sub>, with oxygen saturation in the low 90s, the outside physician made the decision to transfer the patient to our institution which is a tertiary care hospital. She was started on ceftriaxone and azithromycin for community acquired pneumonia, given a left lower lobe consolidation on the CXR. Due to concerns for this being H1N1, she was started on oseltamivir. A rapid flu test was negative, but was later found to be positive by BAL. Upon arrival to our hospital she was placed on BiPAP. Secondary to increased work of breathing with decreasing oxygen saturations, the decision was made to intubate her. Over the first night, it was noticed that she was having increasing respiratory support nearly to the point of maximizing the conventional ventilator. She was also given steroids for fetal lung maturity

Due to her worsening clinical status, we had a case conference the next day where we had members from the surgical intensive care unit, OB, the neonatal intensive care service, and cardiothoracic surgery. There, we created a plan that should there be a worsening in clinical status of the patient or if the fetus started showing signs of distress, that we would call for an emergent C-section that would be done in the SICU, followed by immediate ECMO cannulation and transfer to the CTICU. In addition, due to the premature, yet viable age of the fetus, we had a spare SICU room in which we kept the warmer for the child. We continued ventilator support and used the ARDS protocol to keep her PaO<sub>2</sub> greater than 60 mmHg. To optimize compliance we sedated her, kept her paralyzed and started her on nitric oxide. We were able to keep her stable for about a day and a half when during shift change in the morning; she was unable to keep her saturation greater than low 80s despite aggressive bag mask ventilation. Also, the OB team, who had been watching the baby's tracing, had been noticing un-reassuring decelerations.

The decision was made to follow the plan as outlined above. In few minutes the entire team

was mobilized. The baby was delivered in 45 seconds and the hospital course of the baby is outline below. Immediately following the C-section, the CT surgical team cannulated the patient and she was transferred to the CT ICU. During the time of the procedure, everything went smoothly and all team members had their roles. Everybody acted as planned and there were three anesthesiologists at the bedside to assist with the patient.

The patient remained in the ICU, where she received a trach. She remained on ECMO for 5 days. Her hospital course showed a slow recovery from a respiratory standpoint and care was complicated by persistent vaginal bleeding. She was transferred to the floor after which she met all discharge criteria and she was discharged to an acute inpatient rehab center. After a 15 day stay in the inpatient rehab facility, she was discharged home and continues to improve. Her complications continue to be pleural effusions, generalized weakness and peroneal neuropathy.

### Infant Hospital Course

Infant was delivered by emergent c-section in the SICU secondary to cardiopulmonary failure. C-section with delayed cord clamping for 2 minutes at which time the infant was brought to the open warmer with a heart rate greater than 100, but poor respiratory effort, so positive pressure ventilation was initiated. She was admitted to the NICU where the patient developed respiratory distress and required intubation with subsequent surfactant administration. She was given 2 doses of surfactant 12 hours apart. On day of life 7, she was successfully extubated to CPAP through day of life 9, in which she transitioned to high flow nasal cannula through day of life 26, and weaned to a low flow nasal cannula. She never had any signs of infection or interventricular hemorrhage. She did have hyperbilirubinemia early on her hospitalization and required phototherapy through day of life 6. She did well in the NICU and was discharged.

### DISCUSSION

This case presented many difficult decisions and required great teamwork from all members to allow for the desired outcome for both the mother and the child. One of the most important events that occurred was when the physician in the rural area realized that she should be sent to a tertiary care center where

many more resources are present. It might be prudent for pregnant patients who are quickly worsening to be sent to a tertiary center where many more resources are present. This way, ECMO could potentially be used if it would be deemed useful.

The timing of when to deliver the fetus and by what method was also a difficult decision. It is well published in the literature that the longer one waits to deliver an infant, the more mature the lungs are and fewer co-morbidities which would be present. Examples of comorbidities include respiratory distress syndrome, necrotizing enterocolitis, interventricular hemorrhage and sepsis.<sup>13</sup> Ideally since the mother was under 32 weeks gestation we wanted to give her three doses of betamethasone prior to the delivery of the infant, which was accomplished. We continued to monitor the fetus and the mother and they both started to decompensate at the same time, so the c-section was done prior to the ECMO cannulation to allow for maximum survival for both the fetus and the mother.

In discussion with the OB team, it appears that overnight the baby was starting to have some occasional late decelerations on top of her decreased variability tracing, which they believe showed us evidence that mother was not doing well overnight. They would not have changed the location of the c-section and was happy that everybody was on the same page.

The CT surgery team also thought that everything went well, except they had two ideas, which may have improved the flow of the case. They would have chosen to use a different catheter (Avalon) and they thought that the use of fluoroscopy would have been of great help for proper placement of the catheter.

### CONCLUSION

Even though there have been numerous reports in the literature about patients being on ECMO and then delivering the fetus, we present this case report showing that a c-section prior to ECMO cannulation

is a viable option and can save both the mother and the fetus. There are some aspects which could have been better, including the timing of delivering the infant and whether or not we should have sectioned the mother earlier down in a Hybrid OR with the use of fluoroscopy

when she was more stable. However, this has to be met with the downside of not allowing the fetus to have the full dose of steroids. Due to great teamwork at a tertiary care center, we were able to allow for maximal opportunity for recovery for the mother and the fetus.

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