Inter-hospital transfer of a pregnant prone patient with COVID-19 as a bridge to ECMO

Sir,

Pregnant women are at a higher risk of severe coronavirus disease 2019 (COVID-19) compared to non-pregnant women and are associated with worse outcomes.[1] The management of acute respiratory distress syndrome (ARDS) in a pregnant woman is challenging because of physiological changes of pregnancy and the detrimental effects of hypoxaemia and hypercarbia on the foetus. Prone ventilation and extracorporeal membrane oxygenation (ECMO) are effective rescue strategies in severe ARDS requiring invasive mechanical ventilation. We transferred a pregnant patient with critical COVID-19 on invasive mechanical ventilation (IMV) and prone position as a bridge to ECMO.

A 28-year-old primigravida at 24 weeks’ gestation, with laboratory-confirmed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection was admitted for breathing difficulty and cough since 8 days. She was started on oxygen by face mask to target oxygen saturation (SpO2) ≥94%, dexamethasone 6 mg intravenous once daily and enoxaparin 40 mg subcutaneous 12 hourly. Laboratory parameters showed C-reactive protein 140 mg/L, haemoglobin 12.8 gm%, white cell count 4200/mm³, procalcitonin 1.1 ng/ml, lactate dehydrogenase 680 U/L, D-dimer 1011 ng/ml and normal renal and liver function tests. Her oxygenation worsened the next day, and a trial of continuous positive airway pressure (CPAP) was given in the intensive care unit (ICU). However, because of worsening oxygenation and respiratory distress, the patient was tracheal-intubated and started on IMV with lung-protective ventilation strategy. The patient remained hypoxaemic (partial pressure of oxygen to a fraction of inspired oxygen (PaO2/FiO2) ratio of 67 mm Hg) and higher plateau pressure (Pplat) of 32 cm H2O. She was proned with shoulder and thigh
Support and adequate padding of pressure areas. The abdomen and pelvis were kept in a suspended position. Periodical foetal assessment was performed using cardiotocography and portable Doppler ultrasound, while the suspended abdomen was checked manually for any obstruction or tension. The patient continued to be severely hypoxaemic (PaO$_2$/FiO$_2$ < 80 mm Hg) despite two sessions of prone ventilation of 16 h each. The case was discussed with the ECMO team at Central Command Centre as a potential candidate for ECMO. Given the absence of retrieval ECMO and level III neonatal ICU, an inter-hospital transfer was planned. Due to rapid desaturation on supine positioning, a decision to transfer the patient in prone position was taken.

A team of two anaesthesiologist-intensivists and three ICU trained nurses accompanied the patient. Heart rate, rhythm, arterial blood pressure, end-tidal continuous waveform capnography, SpO$_2$ and ventilator waveforms were monitored continuously throughout the patient care (Table 1). The tracheal tube was firmly secured with a tube holder and standard tie. An intravenous infusion of propofol and midazolam was used for sedation, and cisatracurium was used for neuromuscular blockade. The patient was transferred as a single unit with shoulder and pelvic support from the ICU bed to the ambulance stretcher. One staff was solely dedicated for foetal assessment and airway. An intensivist was responsible for IMV, and another supervised the transfer. The transfer was uneventful with continuous monitoring of the patient and foetus. The ECMO facility was approximately 9 km away and took a travel time of 28 min.

Prone ventilation is an effective rescue strategy for the management of refractory hypoxaemia in severe ARDS by improving ventilation-perfusion matching and reducing mortality.[$^2$] Pregnancy is traditionally excluded from trials on ARDS. However, protocolised proning with due consideration to physiological changes of pregnancy and adequate monitoring is recommended as a low-cost and effective strategy in ARDS management.[3] The transfer in the prone position can be catastrophic with a risk of the misplaced airway and rapid deoxygenation or inability to perform cardiopulmonary resuscitation during an emergency.[4] The systematic planning of transfer with attention to airway, monitoring and pressure areas was found to have been successful in a smaller case series.[5,6] The twin issues of second-trimester pregnancy and prone position made this case challenging. However, adequate planning, team briefing and continuous patient and foetal monitoring ensured a safe transfer. In conclusion, safe transfer of a pregnant, prone patient was possible with adequate planning, risk management and an experienced team.

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Conflicts of interest
There are no conflicts of interest.

Prashant Nasa, Rajesh Phulara, Anamma Georgian, Baisy Zacharia
Department of Critical Care Medicine, NMC Speciality Hospital, Dubai, United Arab Emirates

Address for correspondence:
Dr. Prashant Nasa,
Head, Critical Care Medicine, NMC Speciality Hospital, PO Box 7832, Al Nahda-2, Dubai, United Arab Emirates.
E-mail: dr.prashanthasa@hotmail.com

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Table 1: Vitals of the patient during inter-hospital transport

| Vitals                        | At the start | 10 min | 20 min | On arrival |
|-------------------------------|-------------|--------|--------|-----------|
| Heart rate (beats/min)        | 109         | 114    | 119    | 113       |
| Mean arterial pressure (mm Hg)| 72          | 73     | 75     | 73        |
| Peripheral oxygen saturation (SpO$_2$)| 94% | 93%    | 94%    | 95%       |
| End-tidal carbon dioxide (mm Hg)| 37      | 37     | 37     | 38        |

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