Abstract

We encountered a case of severe acute respiratory distress syndrome in late pregnancy due to influenza (H1N1) with refractory hypoxemia to conventional mechanical ventilation. Ventilation in prone position rescued this patient by maintaining oxygenation and sustaining improvement thereafter. Here, we discuss the mechanism of prone ventilation with special references to safety management of acute respiratory distress syndrome in the third trimester of pregnancy. It requires frequent monitoring of possible complications due to prone position and highly dedicated supporting staffs. More data are required on safety of proneing in the late pregnancy.

Prone ventilation in intensive care unit (ICU) is usually implemented as a rescue therapy of severe acute respiratory distress syndrome (ARDS). This position has its own advantages as well as complications. Complications are infrequent with properly trained ICU staffs. Prone ventilation has been rarely reported in the late pregnancy (third trimester) [1]. We report a case of prone ventilation in pregnant women admitted in swine flu ICU with refractory ARDS due to influenza (H1N1). After obtaining written informed consent, we wish to report the case.

A 25-year-old woman primigravida was admitted in our emergency ward with breathlessness at her 31st weeks of gestation. She was tachypnic (respiratory rate, 34–40 per minute) with pulse oximetry reading saturation of 75% to 80% on 40% oxygen via venturi mask. On admission, arterial blood showed PaO2 of only 46 mm Hg with Pco2 of 52 mm Hg. After intubation, she was shifted to ICU and put on volume-controlled ventilation with a goal of maintaining the plateau pressure up to 30 cm H2O with tidal volume of 6 mL/kg body weight. Sedation was maintained with infusions of midazolam (2-6 mg/h) and fentanyl (50-200 μg/h). However, even with this low tidal volume, her plateau pressure went up to 42 cm H2O. Again, reduction of tidal volume to 4 mL/kg body weight resulted in rise of PaCO2 to 102 mm Hg. She was already receiving 100% oxygen therapy. Then, we changed into pressure-controlled ventilation (PCV) mode but failed to ventilate within the targeted plateau pressure.

Considering difficulties in maintaining oxygenation after 8 hours of conventional PCV, we applied inverse ratio (2:1) PCV under sedation and muscle relaxants. Within 4 hours of inverse PCV ventilation, her PaCO2 went up to 120 mm Hg with little improvement in PaO2. After taking informed consent from relatives, we decided to put her into prone for ventilation (Fig. 1) in view of refractory hypoxemia. Dramatic improvement in oxygenation was noticed after 6 hours of proning with improved PaO2/fraction of inspired oxygen ratio up to 200. Hemodynamics remained stable in prone position without any requirement of inotropes or vasopressors. Lung compliance was also improved during prone positioning. We continued prone ventilation for another 16 hours until the inspired oxygen concentration came down to 50% with a positive end-expiratory pressure of 10 cm H2O. Except transient deterioration after returning supine, her oxygenation status improved compared with just before proning. Three consecutive days of proning helped her lung in such a way that we could wean her off ventilation. Our staffs were very dedicated and experienced in prone ventilation. We ensured availability of proper size equipment every time before proning. We used large rollers below the chest and iliac bone. Here, we choose rollers with adequate height from the bed considering the pregnancy of 31 weeks to prevent abdomen (including major vessels) as well as uterine compression. Pressure points and eyes were well taken care off. We ensured the fetus well-being with cardiotocography, and it remained stable throughout the proning sessions. Patient’s hemodynamics was assured before every proning session with real-time arterial blood pressure monitoring.

We also kept our eyes on to avoid disconnection of lines and tubes and injury during proning. Central venous pressure, passive leg rise test, and echocardiographic parameters guided us for judicious fluids management in supine, whereas systolic pressure variations, during prone position. Chest ultrasound monitoring at certain intervals evaluated any extravascular lung water (Fig. 2). Lead abdominal shield was applied during chest x-ray in supine position (Fig. 3). Obstetric consultation was done at regular interval. Umbilical artery Doppler (Fig. 4) monitoring assured the fetal well-being before and after each proning. There were no significant changes of fetal blood flow due to proning in each time. For H1N1, she received tablet oseltamivir 75 mg daily. After 5 days, her influenza test became negative. We started weaning from fourth day of illness. She could be extubated on the sixth day.

Degree of hypoxia correlates directly with the magnitude of the intrapulmonary shunt, which, in turn, related to the extent of atelectasis. Prone positioning has been used to improve oxygenation in patients with ARDS since 1976 [2]. Mechanical ventilation in the prone position improves oxygenation in approximately 60% of patients with ARDS [3]. This group of people typically has massive collapse consolidation of dorsal lung during supine position. This is partly due to the weight of the overlying heart and high pleural pressures dorsally [4]. After proning, there is realignment of these inhomogeneous collapsed lung units. As regional lung perfusion is not significantly affected by the change in position, it results in improved...
ventilation-perfusion matching and oxygenation. Although the mechanism of this effect is unclear, it is believed to cause more uniform distribution of pleural pressure gradients by increasing transpulmonary pressure gradients, resulting in greater ventilation of the dependent lung segments. Hence, prone positioning acts as a recruitment maneuver. Such improvement in oxygenation allows a reduction in inspired oxygen concentration and mean airway pressure. As a result, it improves the outcome in ARDS. Others possible benefits from prone ventilation are decreased compression on lung by heart, better lymphatic drainage, good secretion mobilization, and release of compression of major vessels by gravid uterus. A recent multicenter study comparing prone and conventional ventilation concluded that although prone ventilation is effective in improving oxygenation, it did not lead to an improvement in survival from acute lung injury and ARDS [5]. It is still a belief, however, that prone ventilation is an appropriate therapy that may benefit subgroups of patients or improve outcome if used early [6].

To our knowledge, the use of prone positioning in severe ARDS in obstetric patient, particularly in the third trimester when aortocaval compression by gravid uterus may occur, has rarely been reported. Keni et al [1] described a report of a road traffic accident in a pregnant patient at 34 weeks of gestation who developed ARDS after blunt chest trauma. Prone positioning over 8 hours resulted in persistent improvement of oxygenation, which allowed extubation in the following day 1. If a pregnant patient with severe ARDS is close to term, it is always better to maintain in left lateral decubitus position to optimize venous return. Use of prone positioning can be considered only in severe oxygenation impairment, as it affects the fetus also. The maternal prone position can provide complete relief of uterine compression of the large vessels [7]. Always use proper protocol before initiation of proning and take adequate preparation to ensure patient’s safety. Regular assessment of fetal well-being and maternal monitoring with multidisciplinary consultations are essential to optimize both maternal and fetal outcomes in severe ARDS in pregnancy.

Acknowledgment

The authors thank Prof VK Grover, Department of Anesthesia and Intensive Care, Post Graduate Institute of Medical Education & Research, Chandigarh, India, 160012.

Sukhen Samanta, MD, PDCC
Department of Anesthesia & Critical Care (Trauma Centre)
JPNA Trauma Centre, AIIMS
New Delhi 110029 India
E-mail address: dr.sukhensamanta@gmail.com

Sujay Samanta, MD
Department of Critical Care Medicine
Sanjay Gandhi Post Graduate Institute of Medical Sciences
Luckow, 226014 India

Jyotsna Wig, MD
Department of Anesthesia and Intensive Care
Post Graduate Institute of Medical Education & Research
Chandigarh, 160012 India

A.K. Baronia, MD
Department of Critical Care Medicine
Sanjay Gandhi Post Graduate Institute of Medical Sciences
Luckow, 226014 India

http://dx.doi.org/10.1016/j.ajem.2013.12.021
References


Fig. 4. Umbilical artery Doppler of the fetus showing systolic and diastolic ratio, pulsatility index (PI), and resistance index (RI).