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Original Article

Management of postoperative ARDS with new methods of noninvasive ventilation in a polytrauma patient

Dr. Pradnya Jagtap, Dr. Sandhya Gujar, Dr. Shirish Chavan, Dr. Sanjay Patil.

ESI-PGIMSR & Model Hospital, Andheri, Mumbai.

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ABSTRACT

33 year old patient came with multiple fractures. After optimizing patient's condition, it was decided to give CSE and interscalene block .Surgery was conducted successfully. On next day, patient developed signs and symptoms of ARDS. Initially he was managed with oxygen by mask. Patient developed hypoxemia, hypercapnia and acidosis with base deficit. So patient was put on NIV (BIPAP). He was given supportive treatment. After 48 hours, patient started improving and maintaining vital parameters. He was successfully weaned off with noninvasive methods of ventilation. And he was later discharged. Acute respiratory distress syndrome is an acute hypoxemic respiratory failure with lung edema of non-cardiac origin. Its primary treatment is mechanical ventilation with endotracheal intubation (positive pressure ventilation). BIPAP is pressure limited, time cycled, spontaneous mode of ventilation which allows spontaneous breathing and low tidal ventilation. It helps in maintaining gas exchange, cardiovascular stability, reducing or eliminating need for heavy sedation and muscle relaxant and shorter duration of ICU stay.

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1. Introduction

Endotracheal intubation with positive pressure ventilation was predominate method for treating respiratory failure till 1960. ARDS mortality remains devastating ranging between 40 to 60% and remains stable over time [1]. But nowadays noninvasive negative pressure devices are used to treat respiratory failure due to COPD or neuromuscular diseases. Although endotracheal intubation and mechanical ventilation are lifesaving procedures, they are associated with multiple complications. It has become largely recognized that mechanical ventilation can further damage the lung, leading to concept of ventilator induced lung injury [2]. Patient with endotracheal tube intubation loses ability to cough, eat and communicate normally. They require atleast some sedation and sometimes muscle relaxation also. So for this reason, intensivists have developed NIV to manage respiratory failure/ARDS.

2. Case report

33 year old male patient came with multiple fractures. There was H/O unconsciousness for 2 hours with no history of ear bleed or vomiting. Patient had mild anaemia. CT Brain was normal. After

optimising patient's condition, patient was taken for surgery. It was decided to give CSE and interscalene block. Blood loss was replaced by giving two units of bloods. Vital parameters were monitored and maintained. Postoperative pain relief was given with epidural analgesia. On postop day 1, patient developed dyspnoea. Patient was desaturated. X ray showed bilateral fluffy shadows in LLZ and RUZ. Patient was diagnosed to have ARDS with septicaemia with thrombocytopenia. Patient was oxygenated with 6 litres of oxygen/minute by mask. Patient could not maintain saturation. ABG showed hypoxia, hypercapnia and acidosis with base deficit. So patient was put on NIV [BiPAP] with PEEP of 5 cm of water with peak inspiratory pressure [IPAP] of 12, EPAP of 4-5 cm of water and FIO2 of 35%. Blood and sputum culture was done. Patient was started on methyl prednisolone, fragmin and Lasix. Blood transfusion was given to patient as haematocrit was low. After 48 hours, patient started improving and was maintaining vital parameters. Patient was breathing spontaneously with good respiratory effort. ABG showed improvement. It was decided to wean off patient from ventilator. Noninvasive ventilation was tapered. Steroids were tapered off and stopped. Patient shifted to ward on 7th day and discharged after one month.

* Corresponding Author : **Dr. Pradnya Jagtap**,
ESI-PGIMSR & Model Hospital Andheri,
Mumbai-400093.
mukta2003@in.com

3. Discussion:

ARDS is defined as a condition in which alveolar capillary membrane is targeted by direct or indirect insult with increased permeability of the barrier [3]. The endothelial part of the alveolar capillary membrane is targeted in case of indirect lung injury as in septic shock. Epithelial part of the barrier is involved in case of pneumonia.

Polytrauma is one of main causes for ARDS. In ARDS, after original injury, two consecutive phases evolve. First or acute phase consist of a nonhydrostatic increased permeability pulmonary edema with accumulation of fluid into the interstitium and alveolar spaces which is termed as diffuse alveolar damage. At this stage lung can completely recover after total fluid resorption and inflammation control or evolve towards second phase. The airsapces are filled with mesenchymal cells [4] and collagen.

Second phase is chronic or fibroproliferative phase which does not recover prolonging stay in ICU, duration of invasive mechanical ventilation and occurrence of ventilator associated pneumonia that leads to increasing risk of death.

Definition of ARDS relies on

- (1) Acute onset of respiratory failure,
- (2) New bilateral infiltrates on frontal chest Xray,
- (3) Severe hypoxaemia as defined as $\text{PaO}_2 / \text{FiO}_2$ ratio >200 mm Hg
- (4) No evidence of increased left atrial pressure.

It is important to recognise and treat etiology of ARDS.

Mechanical ventilation with IPPV and intubation is commonly required in ARDS .It can cause damage to healthy lung due to excess of end inspiratory lung volume (ventilator induced lung injury).

X ray showing bilateral fluffy shadows of ARDS



The disadvantages of IPPV includes increased tendency of dependent atelectasis, worsening of ventilation-perfusion mismatching, decreased oxygen delivery and organ perfusion. It is necessary to use deep sedation or muscle relaxants to maintain ventilation.

Survival of ARDS patients who are undergoing mechanical ventilation has been shown to increase from a reduction in tidal volume and a limitation of end inspiratory inspiratory plateau pressure. Use of low tidal volume with appropriate level of PEEP to ensure lung recruitment is the current standard of care in mechanical ventilation of patient with ARDS.

Volume controlled mode is the most frequently used ventilator mode in the ICU worldwide [5].

X ray after recovery of Patient



However, recent studies cast some doubt about the safety of

this threshold in any patient since overdistension measured from the CT scan was observed in more than 30% of the ARDS patients ventilated with a 6 ml/kg ideal body weight and a plateau pressure below 30 cm H₂O [6]. BIPAP is pressure limited, time cycled, spontaneous mode of ventilation which allows spontaneous breathing and tidal ventilation to accomplish CO₂ clearance. It occurs in reverse sequence from conventional strategies to improve the pathophysiology including gas exchange, cardiovascular function, reducing or eliminating need for heavy sedation and shorter duration of ICU stay. In our patient, we have used this strategy which helped our patient for early and complete recovery.

Conclusion:

Patient with multiple fractures can be managed successfully under regional anaesthesia. Newer modes of ventilation are useful for treatment of postoperative ARDS.

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