

Case Report

Role of noninvasive ventilation in weaning a patient of chronic obstructive pulmonary disease with persistent hypercapnoea from mechanical ventilation

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Abstract

Patients of chronic obstructive pulmonary disease (COPD) presenting with type 2 respiratory failure often require mechanical ventilation. These patients usually end up in prolonged ventilation, ill effects of prolonged intubation and high chances of weaning failure. We are presenting a case of COPD with persistent hypercapnoea who had failed extubation. Patient was later extubated on to noninvasive ventilation (NIV), started on acetazolamide and was weaned from NIV over a couple of days.

Key words: : Noninvasive ventilation, Hypercapnoea, Acetazolamide.

Introduction

Patients with COPD presenting during acute exacerbations pose a challenge to intensive care physicians in that, they have impaired pulmonary functions, high intrinsic PEEP and airway resistance. Hence these patients may require prolonged ventilator support and also present difficulties during weaning from the ventilator. [1,2] The process of decreasing the ventilatory support and discontinuation of mechanical ventilation has been termed as weaning, whereas removal of the endotracheal tube is called extubation. We must always balance between the risk associated with early liberation from ventilator and delay in extubation. In the recent years NIV has evolved as one of the novel approach in weaning patients with COPD from mechanical ventilation. Early extubation on to NIV decreases the duration of mechanical ventilation, length of intensive care unit (ICU) stay, incidence of nosocomial pneumonia and improves survival when compared to conventional weaning.

tuberculosis treated 10 years back with consequent right upper lobe fibrosis, COPD with emphysematous bullae diagnosed on CT scan and Cor pulmonale. She was diagnosed to have acute exacerbation of COPD with Cor pulmonale. She was admitted in medical step down ICU. On examination the patient was conscious, oriented with normal higher mental functions. Patient had mild respiratory distress with respiratory rate of about 24/min. and SpO₂ of 96% with 5L/min of O₂, trachea was shifted to the right and decreased air entry on the left side with crepitations on the right side. She was haemodynamically stable, but with loud P2 and raised JVP. Immediate chest X-ray revealed left side pneumothorax (Fig-1) for which chest drain was inserted. ECG revealed P pulmonale (Fig-2). ABG done showed pH of 7.36, PCO₂ of 70 mmHg, PO₂ of 94mmHg and HCO₃ of 40. Patient was treated with antibiotics, budesonide & ipratropium nebulization and diuretics.

Case History

A 55 year old lady presented to the emergency department with sudden onset of breathlessness since one day. The patient had history of pulmonary

After a day, patient became drowsy and tachypnoeic with respiratory rate of 38/min. She had bilateral crepts and rhonchi but, maintaining SpO₂ of 95% with 6L/min of O₂. ABG showed severe respiratory acidosis with pH of 7.17, PCO₂ of 134, PO₂ of

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Parameters	pH	Pco ₂	Po ₂	Hco ₃
1	7.17	133	94	46.6
2	7.14	-	79	55
3	7.2	147	114	55.3
4	7.21	145	220	55.8
5	7.33	126	119	64.6
6	7.46	97	60	68
7	7.49	84	131	63
8	7.58	77	68	72.4
9	7.64	58	73	63.3
10	7.52	83	58	67.4
11	7.45	51	97	34.9

Table-1. Serial Arterial Blood gas Report

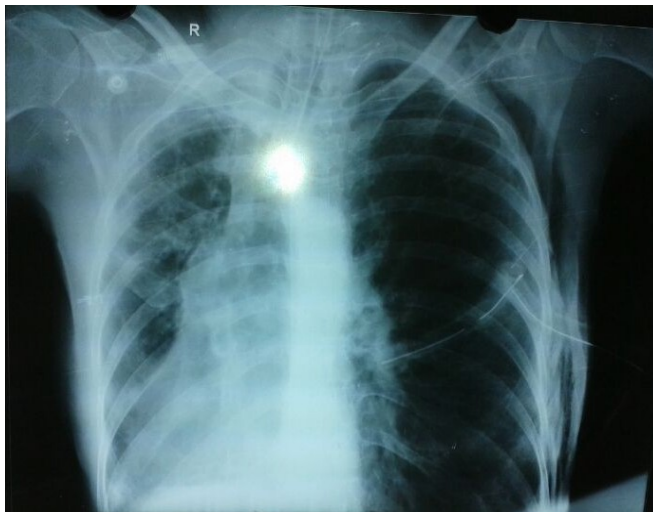


Fig-1:X-ray showing Right Mediastinal shift with ICD on Left side.

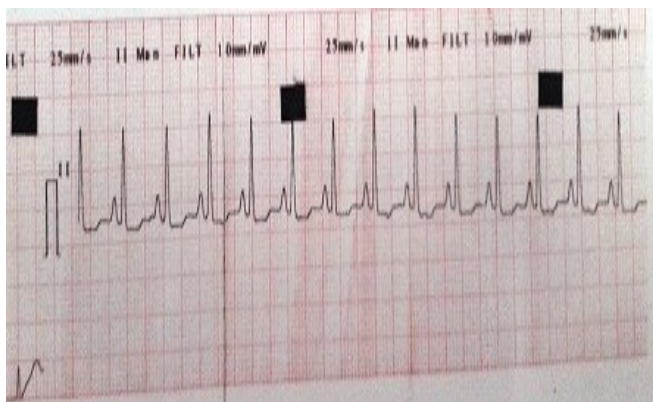


Fig-2: ECG Showing P-Pulmonale

94 mmHg and HCO₃ of 46. Patient was transferred to ICU for further management. Initially the patient was put on NIV for an hour. As there was no improvement in her clinical status she was intubated and was put on ventilator with PRVC- ACMV mode. Serial ABG's (Table 1) were done following admission to the ICU. On day one of ICU, there was progressive worsening of patient's respiratory status. The pH gradually deteriorated to 7.14 and PCO₂ levels went too high and were not measurable (out of range). Patient was continued on ventilator with full support. There was improvement in the patient's clinical status over the next 2 days. On day 3 ABG showed pH of 7.33, pCO₂ of 126mm.

Discussion:

Patients with COPD usually require prolonged mechanical ventilation due to impaired pulmonary functions, high auto PEEP, high airway resistance and hyperinflation of lungs. [1] Weaning from mechanical ventilator is equally difficult due to muscle fatigability and altered gas exchange.[2] Case series and studies by various authors support the use of NIV as a part of an early weaning strategy, when patient fails a trial of spontaneous breathing for patients with COPD.[3,4,5] NIV help the patient by resting the respiratory muscles, improving the breathing pattern and gas exchange. Recent studies have shown that, NIV decreases the duration of ventilatory support, length of ICU stay, incidence of ventilator associated pneumonia (VAP) and improves survival when compared to traditional weaning methods.[4,6]

Our patient had a failed extubation once inspite of satisfying all the criteria for extubation. Prior to extubation, the patient was on minimal pressure support, oxygenating well with minimal O₂ and maintained good haemodynamic stability. Therefore, during the second attempt of extubation, we decided to extubate the patient on to NIV and wean her gradually from NIV. Hypercapnoea with metabolic alkalosis are the main acid base abnormality seen in COPD patients with respiratory failure. Even after normalization of PCO₂, we commonly come across persistent metabolic alkalosis in these patients.[7] Patients with COPD usually develop metabolic alkalosis during weaning from mechanical ventilation.

Acetazolamide is one of the drug used to treat metabolic alkalosis. Following extubation we started the patient on Tab. acetazolamide 250mg.t.i.d. The drug inhibits the carbonic anhydrase enzyme, mainly in the kidney and red blood cells and induces metabolic acidosis. [8,9]

Hence in our patient we used Tab. acetazolamide for treatment of increased serum bicarbonate.

Metabolic acidosis stimulates peripheral and central chemoreceptors, increasing both minute ventilation and PaO_2 .^[10, 11] Hence acetazolamide would help in weaning COPD patients rapidly from mechanical ventilation. The administration of acetazolamide improves arterial blood gas parameters without significantly changing minute ventilation in spontaneously breathing COPD patients.

Conclusion

Extubation on to NIV is an effective ventilation strategy in weaning the patients with acute exacerbations of COPD from mechanical ventilation. We further conclude that, acetazolamide is a useful drug in managing metabolic alkalosis in COPD patient and would also help in weaning the patient rapidly.

References

1. Kelsen SG, Criner GJ. Respiratory pump failure. In: Fishman AP, Elias JA, Fishman JA, Grippi MA, Kaiser LR, Senior RM, Editors. *Fishman's pulmonary diseases and disorders*. 3rd ed, New York: McGrawHill; 1997. p. 2605-27.
2. Mann JJ. The physiologic determinants of ventricular dependence. *Respir Care* 1986;31:271-82.
3. Udwadia ZF, Santis GK, Steven MH, Simonds AK. Nasal ventilation to facilitate weaning in patients with chronic respiratory insufficiency. *Thorax* 1992;47:715-8.
4. Nava S, Ambrosino N, Clini E, Prato M, Orlando G, Vitacca M, et al. Noninvasive mechanical ventilation in the weaning of patients with respiratory failure due to chronic obstructive pulmonary disease. *Ann Int Med* 1998;128:721-28.
5. Ferrer M, Esquinas A, Arancibia F, Bauer TT, Gonzalez G, Carrillo A, et al. Noninvasive ventilation during persistent weaning failure. *Am J Respir Crit Care Med* 2003;168:70-6.
6. Girault C, Paudenthun I, Chevrant V, Tomion F, Leray J, Banmarchand G. Noninvasive ventilation as a systemic exacerbation and weaning technique in acute on chronic respiratory failure. *Am J Respir Crit Care Med* 1999;160:86-92.
7. Khanna A, Kurtzman NA. Metabolic alkalosis. *Respir Care* 2001; 46: 354-365.
8. Swenson ER. Carbonic anhydrase inhibitors and ventilation: A complex interplay of stimulation and suppression. *Eur Respir J* 1998; 12: 1242-1247.
9. Heming N, Urien SK, Fulda V, Meziani F, Gacouin A, Clavel M et al. Population Pharmacodynamic Modeling and Simulation of the Respiratory Effect of Acetazolamide in Decompensated COPD Patients. *PLoS ONE* . 2014 Jan [cited 13 March 2014]; [about 8 pages]. Available from: [http://www.plosone.org/2014/jan.9\(1\):e86313](http://www.plosone.org/2014/jan.9(1):e86313).
10. Brimiouille S, Berre J, Dufaye P, Vincent JL, Degaut JP. Hydrochloric acid infusion for treatment of metabolic alkalosis associated with respiratory acidosis. *Crit Care Med* 1989; 17: 232-236.
11. Berthelsen P, Gothgen I, Husum B, Jacobsen E. Oxygen uptake and carbon dioxide elimination after acetazolamide in the critically ill. *Intensive Care Med* 1985; 11: 26-29.