

Case Report

A Case report on non-invasive ventilation in the management of acute COPD exacerbation. (AECOPD)

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Abstract:

Recent years have seen the emergence of noninvasive ventilation (NIV) as an important tool for management of patients with acute exacerbation of chronic obstructive pulmonary disease (COPD). Several well-conducted studies in the recent years have established its role in the initial, as well as later management of these patients. The aim of this case report is to encourage ICU physician to use NIV on selected AECOPD patients, therefore to reduce the need for endotracheal intubation, the length of hospital stay, and the risk of death. In this case report, we selected a case of AECOPD whose symptoms were getting worse in spite of adequate conventional treatment. He was given NIV for 20 hours following a standard protocol. Final result showed significant improvement in patient's symptoms, vital signs and ABG parameters ultimately patient stay time in ICU was reduced and patient was also benefited financially. From this first ever-successful application of NIV in our ICU we learned that we can use it successfully in next cases.

Key words: Acute Exacerbation, COPD, NIV, NIPPV

Introduction:

Chronic obstructive pulmonary disease (COPD) is chronic progressive airway disorder characterized by airflow limitation that is not fully reversible or fixed¹ (GOLD 2003). The airflow limitation is progressive and associated with abnormal inflammatory response to noxious agents, particularly tobacco smoking. The total number of cases of COPD in the world is approximately 280 million persons² (Celi et al. 2008). Moreover the burden of the disease is expected to rise in future. The World Health Organization (WHO) has predicted that by 2020, COPD will be the 5th most prevalent disease worldwide (currently ranked 12th) and will be among the three leading causes of death³ (Khilnani et al. 2010).

Acute exacerbation of COPD (AECOPD) requires hospitalization. Some hospitalised patients, who need endotracheal intubation and mechanical ventilation,

frequently develop complications related to endotracheal intubation and ventilation, which increases hospital stay and treatment costs. Endo-tracheal intubation has several hazards such as increased risk of Ventilator Associated Pneumonia (VAP), ulceration of upper airway, haemorrhage and long-term complication such as, tracheal stenosis (Khilnani et al. 2010).

Several mechanisms can explain why and how the NIV is beneficial in AECOPD; Noninvasive positive pressure ventilation provides a larger tidal volume with the same inspiratory effort, thus improving alveolar ventilation and decreasing the work of breathing. This treatment can also decrease the work of breathing by partially overcoming auto-positive end-expiratory pressure (auto-PEEP), i.e., pressure remaining in the alveoli at the end of exhalation that is greater than the atmospheric pressure.

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Table 1: Indications and contraindications of NIV⁴ (Liesching et al. 2003)

Indications:

- 1) Acute hypercapnic respiratory failure during acute exacerbations of COPD ($P_{a}O_2$; 7.25 to 7.35, PCO_2 >45, PO_2/FiO_2 ratio <200)
- 2) Acute respiratory failure due to cardiogenic pulmonary oedema
- 3) Acute hypoxemic respiratory failure in immune-compromised patients
- 4) Facilitation of weaning in patients with COPD

Contraindications:

- 1) Cardiac or respiratory arrest
- 2) Non-respiratory organ failure e.g. encephalopathy with GCS < 10, severe upper gastrointestinal bleeding and hemodynamic instability
- 3) Facial trauma, injury and deformity
- 4) Upper airway obstruction
- 5) Uncooperative patient
- 6) Unable to protect airway
- 7) Unable to clear sputum
- 8) High risk of aspiration

Since SARS, another contraindication for NIPPV in this ICU is all community acquired pneumonias and suspected SARS

Case Report:

Mr. Abdul Gani 52 years old male was admitted in our ICU with chief complaints severe breathlessness and sweating for last 5 hours. Before this acute condition he has also history of hardly able to do anything by himself, even taking a bath or getting dressed makes him short of breath since last one year. Previous medical diagnosis was Stage 1 COPD 4 years back and he used to take Ticamet (salmeterol+Fluticasone) he is not diabetic or hypertensive but he suffered from bronchitis with upper respiratory infection for 3 times last year. He was a smoker and used to smoke 1 packet per day for 30 years - has quit 1 year ago. His mother died of cancer colon 3 years back and his father died 2 years back with stroke.

On admission his general appearance was; 52-years-old male in acute respiratory distress using accessory muscles of respiration at rest, which indicate severity of distress. His Vitals were: Temp. 98.8F, HR 115-120 bpm & regular, RR 28-30^opm, BP 150/90 mmhg. He had no cyanosis and clubbing, there was mild jugular distension. He was drowsy but easily reusable, oriented.

His skin was warm which was a sign for CO₂ retention. On auscultation, breath sound was diminished bilaterally, Ronchi throughout bilateral lung fields, on percussion hyper resonant lung field. A chest radiograph showed hyper inflated lung field, low and almost flat diaphragm. A blood gas showed pH; 7.30, PO_2 ; 62, mmhg PCO_2 : 64 mm hg HCO_3 : 29. mmol/l Nothing abnormality detected on examination of abdomen.

The admitting diagnosis was Acute exacerbation of COPD with right basal pneumonia therefore he was treated with O₂ 2L/min via nasal cannula to achieve O₂ saturation 90-91%, IVF D5 NS with 20mEq KCL @ 80ml/hr , Corticosteroid -Hydrocortisone 100 mg 6 hourly, Antibiotic -amoxicillin 500mg TDS, Inhaled bronchodilator: Ipratropium bromide 6 hourly, salbutamol every half hourly. Later on we added aminophylline; initially 5 mg /kg bolus with in 20 min then 500microgm/kg/hr. ABGs q 8 hours, CXR, sputum cultures and Gram stain were done.

On second day of admission his condition deteriorated: his distress became more pronounced, his work of breathing increased significantly, he became confused, SpO₂ went down 80 to 85% with 5L O₂/min, a blood gas parameter showed pH; 7.27, PO_2 : 55, PCO_2 , 72, Hco_3 : 30, therefore, with the consent of patient's relatives NIV was added along with the conventional treatment. The NIV was applied as follows:

- Patient was explained about the process.
- Patient kept propped up position to provide effective ventilation and help to prevent aspiration
- Noninvasive ventilation started in sitting position with initial settings of IPAP 8 cm H₂O and EPAP 4 cm H₂O. Gradually IPAP and EPAP were increased 1 cm every 15 minutes up to IPAP 12 cm and EPAP 6cm H₂O (best tolerated by this patient). FiO_2 was adjusted between 45 to 50% to keep the SpO₂ 90%.
- Patient was disconnected from ventilator for 10 minutes in every 2 hour and only during feeding.

Patient was kept in close monitoring with hourly recording of vital signs, conscious level. Blood gas was measured after 2 hours of administration of NIV and every 6-hour interval.

There was gradual improvement of patient's symptoms and blood gas parameter. After 20 hours of NIV patient's clinical condition significantly improved. Table 2 showed serial recording of vitals and blood gas

Table 2: Vitals and blood gas parameters on arrival, before starting NIV, during NIV and 6 hours after discontinuation of NIV. All data was collected at 6-hour interval.

Parameters	On arrival in ICU	Just before NIV(2 nd day)	2 hrs after NIV	At 6 th hour of NIV	At 12 th hour of NIV	At 18 th hour of NIV	6 hour after discontinuation of NIV
HR	115 to 125	122-127	105 to 110	95 to 110	85 to 90	80 to 90	80 to 85
RR	28 to 30 br/min	33-36br/min	25 br/min	23-25br/min	20 to 22 br/min	14br/min	14br/min
BP	150/90	155/90	145/90	150/85	140/85	130/70	135/70
ABG	pH; 7.30, Po ₂ ; 57,mmhg PCO ₂ : 64 mm hg Hco ₃ : 29. mmol/l	pH; 7.27, Po ₂ ; 55,mmhg PCO ₂ : 72 mm hg Hco ₃ : 30. mmol/l	pH; 7.32, Po ₂ ; 59,mmhg PCO ₂ : 52 mm hg Hco ₃ : 31. mmol/l	pH 7.36 Po ₂ ; 64,mmhg PCO ₂ : 50 mm hg Hco ₃ : 30. mmol/l	pH; 7.37, Po ₂ ; 67 mmhg PCO ₂ : 47 mm hg Hco ₃ : 29 mmol/l	pH; 7.44, Po ₂ ; 65 ,mmhg PCO ₂ : 44 mm hg Hco ₃ : 26. mmol/l	pH; 7.41, Po ₂ ; 68mmhg (with 2L/min O ₂ via nasal cannula) PCO ₂ : 42 mm hg Hco ₃ : 27. mmol/l
All data of vital signs are presented in a range.							

Discussion:

Several randomized trials (Brochard et al. 1990, Meduri et al. 1991, CRG 2005, Plant et al. 2000) have shown NIV to be beneficial in acute hypercapnic COPD

Exacerbations. Recent meta-analysis (by Lightowler et al. 2003), of eight studies showed that, NIV along with conventional pharmacological treatment when compared with conventional treatment alone, was associated with lower mortality rate (relative risk 0.41; 95% confidence interval [CI] 0.26-0.64), reduce the incidence of endotracheal intubation (relative risk 0.42; 95% CI 0.31-0.59), lower rate of treatment failure (relative risk 0.51; confidence interval 95% CI 0.38-0.67), greater improvements in the 1-hour post treatment pH and PaCO₂ levels, reduce respiratory rate, reduce the length of stay in the hospital⁵ (Gershman et al. 2008). Consistent With the previous study our case report also showed NIV has a similar efficacy and benefit when

used in selected case of AECOPD. In most of the studies the researchers administered NIV using facial mask. In our study we also have used facial mask but a nasal mask is more patient compliant than a facial mask therefore, we can use nasal mask if available. In most of the successful study it is seen that NIV was administered in ph between 7.25-7.35. In our case study we have applied NIV when patient's PH

was 7.27. We tried to keep the patient on NIV as much time as possible to get a good result but we also had to take measures to avoid pressure sores. If there is no improvement of arterial blood gas within first 2 hours and if patient's condition and blood gas parameter deteriorate further we should discontinue NIV and ofcourse think for Intubation and mechanical ventilation. We believe that each and every ICU in Bangladesh can use NIV effectively if only have trained medical staff thereby, can reduce complication related to

Conclusion:

Though only with this single case report we can not determine its efficacy in our clinical setting but On the basis of previous successful controlled trials, we can conclude that administration of NIV in COPD patients who still have good physiological reserve (ph not less than 7.25) can give significant benefit to patient. However, it should not be used as a substitute for intubation and mechanical ventilation if these are needed or if the patient is at risk of aspiration.

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