CASE SERIES

Non-invasive ventilation is helpful in early weaning and early extubation in H1N1 infected, ventilated patients: a case series

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ABSTRACT

The spread of 2009 pandemic of H1N1 increased the number of patients being admitted to intensive care unit with acute respiratory failure. Conservative approach in extubation in view of severe lung injury leads to prolonged mechanical ventilation and is further complicated by development of superadded bacterial infections. In a developing country with a large population and limited health care resources all attempts need to be made to decrease hospital stay. We present a case series of four patients, confirmed to have H1N1 associated respiratory involvement and who were put on non invasive ventilation (NIV) early in the phase of weaning. The weaning and early extubation was successful in all of these patients. We conclude that NIV in post extubation period facilitates weaning and early extubation in patients with H1N1 viral pneumonia, who were on mechanical ventilation.

Key words: H1N1, Non Invasive Ventilation, Weaning, critical care; acute lung injury

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INTRODUCTION

Decision to wean off mechanical ventilation the patients, who had had a period of hypoxic respiratory failure before being ventilated, is one of the most challenging for an intensivist. Clinicians have been conservative in extubating these patients and 40% of total duration of mechanical ventilation time in these is spent in weaning them off [1]. We cared for a recent subset of patients with severe lung injury, infected with H1N1 influenza virus which was responsible for the 2009 pandemic[2]. We describe in our case series the effectiveness of noninvasive ventilation in averting respiratory failure in patients with viral pneumonia and acute respiratory distress syndrome (ARDS) when applied intermittently for 48 hours after extubation in intensive care unit. The ventilator mode initially used in all these patients was synchronized intermittent mandatory ventilation with volume control (SIMV-VC) with preset tidal volume (6 ml/kg body weight). Extubation was planned after patient was weaned to pressure support of 12cm H_2O, positive end-expiratory pressure of 8 cm H_2O and an FiO_2 of 0.5.

CASE 1:

A 35 year old male with four days history of flu like illness was admitted in isolation ward of our hospital where he was subsequently tested positive for H1N1. His oxygen saturation (SpO_2) at time of admission was 74% on room air which increased to 95% on facemask and his total

leucocyte count (TLC) was 29,000cells/mm^3. Clinical deterioration was seen on second day when he complained of breathlessness with arterial blood gas (ABG) report showing a PaO_2 of 56 mmHg and a $PaCO_2$ of 48 mmHg. His chest X-ray suggested bilateral lower zone consolidation. He was intubated and shifted to intensive care unit (ICU). To maintain SpO_2 above 88% high FiO_2 (100% oxygen) and high positive end-expiratory pressure (PEEP) of 18 cm H_2O were used for the first 24 hours. By the sixth day, the patient was afebrile with a favourable trends in TLC, ventilator effort and ABG's, hence the ventilator was switched from mandatory to spontaneous mode. Ratio of the partial pressure of arterial oxygen to the fraction of inspired oxygen (PaO_2/FiO_2) had improved from 65 to 200 mm Hg but there were diffuse infilterates in bilateral lower zones in the chest X-ray. We decided not to wait for radiological improvement and extubate the patient and switch to non invasive ventilation. For two days after extubation, NIV was employed using facemask intermittently during the day and continuously during the night. After 10 days, the patient was comfortable and maintaining saturation on room air with complete radiological clearance when discharged from the ICU.

CASE 2:

A 24 years old female presented with complaints of diarrhoea for the last four days. She was dehydrated with blood pressure of 98/60 mm Hg, pulse rate of 130/min, bilateral crackles on chest auscultation and a saturation of 82% on room air, when seen in the emergency department. Chest x-ray showed bilateral diffuse infiltrates in lower and mid zones. H1N1 testing reported her as positive. She developed breathlessness the very next day and had to be intubated and shifted to ICU. Her PaO_2/FiO_2 ratio improved from 95 to 250 mm Hg within four days but the secretions during endotracheal suctioning, which were minimal initially, became copious. A day later, she improved and was extubated to be switched to NIV for two days on SIMV. The mode was later changed to spontaneous breathing with further improvement in her condition. Then she was oxygenated using facemask (FiO_2 of 0.4). Her blood investigations showed leukocytosis (18,000 cells/mm^3) and the chest x-ray was suggestive of resolving pneumonia when shifted back to the ward.

CASE 3:

A 51 year old female with past medical history of asthma presented to the emergency department with respiratory failure. She was intubated and shifted to ICU for mechanical ventilation. Chest x-ray showed a non homogenous opacity on her left mid zone and diffuse infiltrates in right hilar region. Bronchial specimens tested positive for H1N1 virus and klebsiella pneumoniae sensitive to quinolones, aminoglycosides and azithromycin. She had bilateral crackles on chest auscultation with large amount of mucopurulent secretions. Antibiotic cover was provided. For first six days, high PEEP (15 cm) and high FiO_2 (0.60) were needed to maintain saturation above 90%. By seventh day, the weaning process was started; and she was extubated and put on NIV on the eighth day. Continuous nocturnal NIV for 3days was needed to prevent hypoxia and hypercapnia. She was shifted on Ventimask maintaining SpO_2 above 90% with FiO_2 0.33.

CASE 4:

A young man of 23 years, presented to the community hospital with fever and petechiae and was tested positive for dengue IgM. He had a low platelet count and thus was managed with platelet transfusions. After four days his platelet count was 50,000 cells/mm^3. During his stay in hospital he developed pneumonia, derangement in liver and renal functions and coagulation abnormality. Results of biochemistry reported; creatinine 2.6mg/dl, total bilirubin 2.7 mg/dl (direct reacting fraction of 0.6mg/dl), SGOT 2560 U/dl, SGPT 559 U/dl and prothombin time of 32 sec (control value 12sec). He was intubated and referred to our hospital for H1N1 testing and mechanical ventilation when he developed acute respiratory failure. He had severe lung injury (PaO_2/FiO_2 ratio of 88) and right sided consolidation, both clinically and on chest x-ray films, involving all zones at the time of admission. He subsequently tested positive for H1N1 and was kept on ventilator for the next five days till his platelet count normalized and renal and hepatic functions improved. Weaning was started by sixth day and he was shifted to NIV on seventh day for the next two days. He too was successfully discharged from ICU and oseltamivir 75mg twice daily was administered for a total duration of ten days.

DISCUSSION

We describe in our case series the successful use of early post-extubation NIV to expedite weaning in patients with viral pneumonia due to H1N1. None of our patients had to be reintubated and oxygenation (SpO_2) was maintained above 92% in all with use of NIV. Weaning and extubation were done aggressively without waiting for radiological improvement and without a T-piece trial. The criteria set for extubation were an afebrile period of 24 hours with a

decreasing trend in leucocyte count and a minimum arterial oxygen level of 90 mm Hg with positive end-expiratory pressure of 8 cm H_2O and FiO_2 0.5.

H1N1 infection can lead to severe lung injury and ARDS and necessitates establishment of ICU's with advanced ventilatory techniques like high frequency oscillatory ventilation (HFOV) and rescue therapies like extracorporeal membrane oxygenation (ECMO). In a developing country like India it is not possible to have such facilities at all hospitals. The prognosis is bad for those who have refractory hypoxia and need prolonged invasive mechanical ventilation. From August to December 2009 a total of 60 patients were admitted in our ICU with confirmed or suspected H1N1 infection. All patients were young adults and had leucocytosis, were febrile with chest x-ray films showing consolidation involving lower and middle zone. It has been observed that after 48-96 hours of administration of oseltamivir there is a period in which the patients become afebrile with a decreasing leucocyte count but with no improvement in radiological picture. Attempts should be made at this stage to aggressively wean and extubate the patient. The reappearance of fever signifies development of superadded bacterial infections and worsening clinical condition.

Non-invasive ventilation is relatively contraindicated in H1N1 positive cases as these patients are prone to develop ARDS. Severe hypoxia and reduced compliance necessitate the use of high PEEP and high FiO_2[3]. But it can be used to prevent post-extubation respiratory failure in patients with resolving ARDS secondary to H1N1 infection preferentially when the patient has received oseltamivir and is afebrile and no longer contaminated. Another reason discouraging use of NIV is the possibility of spread of infective aerosol from patient to healthcare personal and other patients[4]. But it is to be noted that in the phase of resolving pneumonia there is overproduction of mucus which needs frequent suctioning and nebulization both of which themselves are also aerosol generating procedures. It has been proven that NIV helps in airway clearance and prevents airway collapse[5,6], whereas with endotracheal intubation the flows generated with patient cough are submaximal[7,8] and a lack of continual suctioning may prevent effective clearance of secretions leading to risk of mucus plugging or choking.

NIV requires patient cooperation and thus was best suited for our subset of patients as majority of them were young adults with no co-morbidities. A conventional extubation protocol if followed in these patients would lead to unnecessary hospitalization and risk of nosocomial infection. NIV is an easily available mode of ventilation and does not entail high equipment cost. In developing countries, a reasonable utilization of available resources is of prime importance as limited medical facilities have to cater for a large population.

CONCLUSION

We conclude that NIV is a useful method to facilitate early weaning and early extubation in H1V1 patients with associated lung involvement, especially in the resolution phase and who meet a predetermined set of criteria.

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