



Prone Position and NIPPV in Influenza A (H1N1) Related Severe ARDS, A Successful Story

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Abstract

We report a case of 17 years old Saudi female who was admitted with sever ARDS secondary to H1N1 Pneumonia which was treated with Noninvasive ventilation and prone position with full recovery. To our knowledge, few case reports have discussed prone positioning in patients while on NIPPV.

Keywords: ARDS; Noninvasive ventilation; Prone position; H1N1

Introduction

Prone position is one of the rescue therapies that can be used in moderate/severe acute respiratory distress syndrome (ARDS) and found to be associated with less mortality if combined with low tidal volume (Vt), plateau pressure less than 30 cm H₂O and applied for at least 17 hours per day. The prone position improves oxygenation parameters and respiratory mechanics through different mechanisms including; decrease in the volume of lung collapse, improvement in ventilation-perfusion matching and causes more homogenous dispersion of Vt which minimizes alveolar stretch and strain. While it is commonly used now in intubated mechanically ventilated patients with moderate /severe ARDS, it is seldom combined with noninvasive positive pressure ventilation (NIPPV). The use of NIPPV is associated with less need to intubation and less mortality in cases of acute exacerbation of chronic obstructive pulmonary diseases and cardiogenic pulmonary edema, while its beneficial effects in sever ARDS due to pneumonia is still unclear. A trial of NIPPV is worthwhile in patients with mild and moderate ARDS and cautiously in sever ARDS who do not require immediate intubation, hemodynamically stable, able to tolerate wearing a face mask, and able to maintain a patent airway. Here we report a 17 year old female who presented with severe ARDS secondary to H1N1 pneumonia and treated with NPPV and prone position with complete recovery.

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Case Presentation

This is a case of 17 year old Saudi female not known to have any chronic medical illness, admitted with 5 day history of sore throat, undocumented fever, runny nose, cough, and fatigue and progressed to severe shortness of breath on the day of admission. She was exposed to her parents and two other siblings who were having mild respiratory symptoms but were not admitted to the hospital. She denied loss of consciousness, hemoptysis, or leg swelling. There were no associated gastrointestinal and urinary symptoms noted.

Physical examination

The patient was conscious, alert, oriented to time place and person, ill looking, in respiratory distress with respiratory rate (RR) of 40/minute, blood pressure: 130/72 mmHg supine, heart rate 133/minute and regular, temperature 37.1°C and arterial oxygen Saturation (SaO₂) was 78 % to 84% on room air which increased to 88-92% on high flow oxygen mask. JVP was normal; trachea was central, no palpable lymph nodes and no thyroid enlargement. Cardiovascular system was unremarkable, chest with decreased air entry, coarse crepitation bilaterally and scattered wheezes all over lung fields. Abdomen was soft, lax, non-tender, no organomegally or ascites. Lower limbs: no edema, intact peripheral pulses.

Table 1: Patient's blood gases while on prone positioning over 3 days on NIV.

Data	Day1: 29-07-2015							Day 2 30-07-2016		Day 3 31-07-2017
	Supine Position	Before Prone	(1 hour) After Prone	(5 hours) After Prone	(12 hours) After Prone	(17 hours) After Prone	(20 hours) After Prone	(4 hours) After Prone	Supine Position	(5 hours) After Prone
FiO ₂	60%	60%	60%	60%	60%	50%	45%	45%	45%	45%
PS	12	12	12	12	12	12	12	10	12	8
PEEP	10	10	10	10	10	10	10	9	10	10
VT	500	450	323	295	389	371	381	306	300	327
RR	40	35	32	31	30	28	30	28	31	26
PH	7.35	7.41	7.43	7.42	7.41	7.41	7.43	7.36	7.41	7.44
PCO ₂	40	19	37	36	38	40	37	33	25	35
PaO ₂	94	75	83	90	181	145	96	161	67	132
SaO ₂	96%	95%	99%	98%	100%	99%	100%	99%	95%	99%
P/F	156	125	138	150	300	290	213	357	148	293

FiO₂: Fraction of Oxygen in the Inspired Air; PS: Pressure Support; PEEP: Positive End Expiratory Pressure; VT: Tidal Volume; RR: Respiratory Rate; PH: Power of Hydrogen (acid/basic); PaCO₂: Partial Pressure of Carbon dioxide; PaO₂: Arterial Partial Pressure of Oxygen; HCO₃: Bicarbonate, O₂ sat: Oxygen Saturation; P/F: PaO₂/FiO₂

Investigation

Arterial blood gases (ABG) on arrival to ER showed: (room air) P^H-7.39, PaCO₂-23, PaO₂-42, HCO₃-18.7, SaO₂-77%, CBC: WBC-16,000 (86% neutrophils), Hb-12 gm/dl, platelets 268,000/mm³. Electrolytes, renal and hepatic functions were all within normal. Chest x-ray (Figure 1) showed bilateral lung infiltrates.

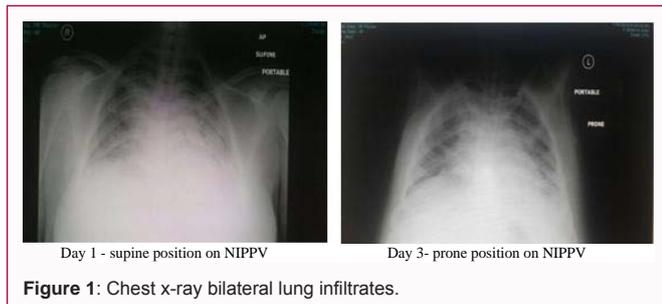
Nasopharyngeal swab was sent for influenza virus, test using reverse transcriptase polymerase chain reaction (RT-PCR) and it came to be positive for Influenza A (H1N1). Sputum, urine and blood cultures revealed to be all negative. The patient was admitted to the adult intensive care (AICU) as acute Hypoxic respiratory failure (severe ARDS) with bilateral acute lung infiltrates as shown in chest X ray and ratio of arterial oxygen tension to fraction of inspired oxygen (Pao₂/FiO₂, P/F) less than 100: secondary to H1N1. As she was conscious, hemodynamically stable, accepted and tolerated to be on NIPPV, with (FIO₂ of 60% and maximum inspiratory pressure of 12 cmH₂O and PEEP 10 cm H₂O). Tamiflu 75 mg BID, ceftriaxone 2 gram daily and levofloxacin 750 mg daily were started. Eight hours after AICU admission patient remained hemodynamically stable but still in respiratory distress, she was kept on NIPPV with repeated blood gas showing PaO₂ further decreased from 94 mmHg, 4 hours after NIPPV to 74 mmHg, 8 hours later. Patient was flipped to prone position while on NIPPV with help of 4 ICU staff while her lines and NIPPV circuit were secured by one of the staff. Prone position was kept for 17 hours every day for total of 3 days. Patient tolerated the position every day with no any adverse events. There was significant persistent improvement of her oxygenation as shown on Table 1. On day 4 she was on intermittent NIPPV and we stopped to prone here and remained with good oxygenation and less respiratory distress. On day 5 she was off NIPPV until she was out of ICU on day 10 on only nasal cannula of 2 liters/minute.

This is a case of 17 year old Saudi female not known to have any chronic medical illness, admitted with 5 day history of sore throat, undocumented fever, runny nose, cough, and fatigue and progressed to severe shortness of breath on the day of admission. She was

exposed to her parents and two other siblings who were having mild respiratory symptoms but were not admitted to the hospital. She denied loss of consciousness, hemoptysis, or leg swelling. There were no associated gastrointestinal and urinary symptoms noted.

Discussion

The case we are presenting is the first in the literature of severe ARDS due to H1N1 and treated with NIPPV and prone position. While she was on NIPPV maintaining a SaO₂ above 92%, she was still tachypneic, her PaO₂/FiO₂ was still significantly on lower side, (she was fully conscious with secured airway and hemodynamically stable), we decided to give her a trial of prone position while on NIPPV and she had shown a significant improvement in her SaO₂ and an excellent improvement in PaO₂/FiO₂. Patient was kept on prone position for 17 hours per day for 3 days with daily significant improvement of the same parameters. By day 4, patient was kept on and off NIPPV and by day 5 she required only simple face mask with FiO₂ less than 0.5 and oxygen saturation was maintained above 94%. Finally patient was discharged on day 10 of ICU admission with complete recovery and without any complications. We successfully combined the use of NIPPV with prone positioning to optimize gas exchange in our patient, a strategy seldom described in the literature. This combination was used in case reports of refractory hypoxemia post bilateral lung transplantation and transfusion related acute lung injury (TRALI). There is potential for H1N1 to induce severe pneumonia and ARDS and to require invasive or noninvasive mechanical ventilation support. NIPPV is now standard of care in management of acute exacerbation of COPD and cardiogenic pulmonary edema as it can reduce intubation and mortality rates in patients with severe acute exacerbation of chronic obstructive pulmonary disease [1-3] or cardiogenic pulmonary edema [4] but its role in ARDS related to severe pneumonia is still unclear. In spite of that there are some case reports of H1N1 related ARDS treated with success using NIPPV [5]. A survey shows that NIPPV is increasingly used in patients having acute hypoxemic respiratory failure (AHRF) and is initiated as first-line ventilatory support in 20% to 30% of such patients [6,7]. NIPPV has even been tried as the



first-line ventilatory support in patients having clinical criteria for acute respiratory distress syndrome (ARDS) [8,9] with a success rate of more than 50%, especially in patients with prompt improvement of oxygenation among some other predictors of success such as age less than 40 years, no deterioration of oxygenation on NIPPV after 1 hour trial, SOFA score less than 6 and absence of multiorgan dysfunction, and all of these were found in our patient encouraging us to try NIPPV in spite of her severe form of ARDS [8]. Rocker et al. [10] found that there was a 66% success rate when NIPPV was used as the initial mode of assisted ventilation in patients with ARDS. The role of NIPPV in ARDS secondary to severe pneumonia is still controversial. Analysis of the first randomized trial of NIPPV in 56 patients with pneumonia revealed that only the subgroup of patients who had concomitant COPD appeared to benefit from NIPPV [11]. Among the available reports even with invasive ventilator, the mortality rate reached nearly 60% for H1N1-related ARDS [12]. Current evidence therefore suggests as in our case that NIPPV may be a reasonable choice in some patients with severe ARDS if they show prompt response and the intubation facility is standby [13]. In the scenario of scarcity for invasive ventilators during the infectious outbreak, the expeditious use of noninvasive ventilation would help conserving the equipment for those who need it most. Prone position was of great help in the management of the case we are reporting as it is known to cause better oxygenation by facilitating the recruitment of collapsed alveoli in the dorsal regions of the lungs and through the improvement of the ventilation/perfusion matching caused by a shift in pulmonary perfusion to the ventral regions [14]. The prone position requires training of the ICU staff, particularly with regard to the proper and safe turning of patients, tubes, and catheters during position change [14,15] and our ICU used to use prone position as in some other centers frequently according to latest evidence for patients with severe ARDS according to Berlin definition. Recent evidence supports that using prone position in intubated patients with severe ARDS for at least 17 hours per day, for at least 3 days when combined with protective lung strategies was associated with better outcome and decreased mortality (meta-analysis, some ref.). For the best of our knowledge our case is first to be reported as H1N1 related severe ARDS treated with NIPPV and prone position and it may open a channel for research comparing using this combination versus NIPPV alone in moderate or severe ARDS when feasibly indicated.

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