

High Flow Nasal Oxygen therapy in a young pregnant patient with hypoxemic respiratory failure due to H1N1 influenza viral infection

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Pregnant women are at high risk of infection with the novel H1N1 influenza A virus. A 30-year-old pregnant woman at 35 weeks of gestation was admitted with acute onset fever, cough and shortness of breath with hypoxaemic respiratory failure. Laboratory investigations confirmed influenza A infection. This case report illustrates how High Flow Nasal Oxygen device gave good results in hypoxemic respiratory failure especially in the setting of possible unexpected infections and ventilator associated pneumonia.

Keywords: H1N1 influenza; high flow nasal device; oxygen therapy; modes of ventilation

Introduction

Pregnancy and postpartum period are considered increased risk factors for hospitalization, ICU admission, delayed recovery and death following H1N1 Influenza viral infection. World Health Organization says globally there is a decreasing trend in seasonal influenza. In tropical Asia, the trend is same. There are no recent data available from Sri Lanka, but cases of influenza continue to be reported from all areas of the country.

High Flow Nasal Oxygen device, a new respiratory therapeutic technique which provides warmed humidified high flow oxygen through a nasal cannula is used in patients with hypoxemic respiratory failure. The high flows (e.g. 50L) match with the patient's peak inspiratory flow rates.

In addition, it reduces anatomical dead space and creates a positive pressure in upper airways. Studies

demonstrated that High Flow Nasal Device (HFND) provides better oxygenation when compared with conventional face masks and nasal cannulas.¹

Case Presentation

A 30yr old woman in her second pregnancy presented at 35weeks period of gestation with a 6-day history of high grade fever, non-productive cough and shortness of breath to Base hospital, Mawanella, Sri Lanka. First pregnancy had been an emergency cesarean section due to foetal distress. She had been in good health throughout this pregnancy, gave no history of travels or exposure to anyone with probable influenza. She had no chronic medical issues and did not smoke. She was not vaccinated against influenza.

On admission, she was reported to have respiratory distress with peripheral oxygen saturation (SpO₂) of 85%. She was transferred to intensive care unit (ICU) Teaching Hospital, Peradeniya. On arrival, she was conscious, rational with Glasgow coma scale of 15. She was febrile and tachypnoeic at 40breaths/minute. Chest examination revealed bi-basal reduced breath sounds with rhonchi and coarse crepitations. SpO₂ on air was 85%. Her HR was 127beats/minute and BP was 112/64mmHg. Abdominal examination revealed a single live fetus. Arterial blood gas analysis (ABG) showed pH:7.42, PaO₂:56mmHg, PaCO₂:25mmHg, HCO₃Std: 19.5mmol/L, BEecf: -8.3, SO₂: 89% and

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Received: 30/08/2017

Accepted: 09/10/2017

DOI: <http://doi.org/10.4038/slja.v26i1.8273>



lactate: 0.6mmol/L. Initial laboratory investigations included white blood cells (WBC): 6.4 cells/L³, neutrophils: 64%, lymphocytes:32%, haemoglobin: 11.9g/dL, platelets:148 cells/L³, C- reactive protein (CRP): 70.6 mg/dL, alanine transaminase (ALT): 41U/L, aspartate transaminase (AST):89U/L, Serum sodium: 139mmol/L, potassium:4.4mmol/L, international normalized ratio (INR):1.02, respiratory secretions positive for Influenza A. Chest X ray showed bilateral alveolar infiltrates involving middle and lower zones. The tentative diagnosis of H1N1 or community acquired pneumonia was made.

She was given 60-80% oxygen via a face mask with reservoir bag. Oral oseltamivir 150mg twice daily, intravenous ceftriaxone 2g twice daily with oral clarithromycin 500mg twice daily was started. Regular nebulizations with bronchodilators, deep vein thrombosis prophylaxis with pneumatic compression device and enoxaparin s.c. was provided. Regular obstetric team visits ensured proper foetal wellbeing. Her haemodynamic parameters were maintained throughout the ICU stay.

On the second day although she remained tachypnoeic, her ABG showed improvement in oxygenation as pH: 7.33, PaO₂: 121mmHg, PaCO₂: 23mmHg. Temperature had settled. 2D echocardiogram revealed good cardiac function. US chest revealed no pleural effusions.

Following multidisciplinary meeting it was decided to deliver the baby by urgent cesarean section. Lower segment cesarean section was performed under combined spinal epidural anaesthesia. Throughout the surgery CPAP with 70% oxygen (PEEP 5mmHg and Pressure support 10mmHg) was continued. Intraoperative period was uneventful and 1.8kg healthy baby was delivered and sent to premature baby unit for observation. Post operative analgesia was provided via epidural route.

On the 3rd day of ICU stay, fever recurred and there was a drop in arterial oxygenation. ABG revealed pH: 7.49, PaO₂: 84mmHg, PaCO₂: 36mmHg with saturation around 97%. Even though there was no significant clinical deterioration, her chest X ray

revealed extension of alveolar infiltrates towards the apices. CPAP was continued with same settings.

Because of worsening tachypnoea and deteriorating arterial blood gases need for intubation was discussed. Patient was started on High Flow Nasal Device (HFND) with 70% oxygen (45L/min). The tolerability and patient's comfort improved with HFND. She was able to express herself, take oral feeds and start on breathing exercises while continuing HFND.

On the 4th day she became afebrile. Sputum culture revealed pseudomonas growth which was sensitive to meropenem. Urine culture showed growth of *Candida albicans*. Because of positive cultures antibiotics were changed to intravenous meropenem and oral fluconazole was started for candidiasis. Mycoplasma serology, sputum for fungal studies and blood cultures were negative. Procalcitonin level revealed no evidence of sepsis. Respiratory parameters remained static and ABG showed pH:7.45,PaO₂:91mmHg, PaCO₂:39mmHg.

On 5th day, respiratory support was continued via HFND with 60% oxygen. Respiratory rate (RR) remained around 35-40 breaths/min. Although she had a mild fever spike, her WBC count was 8.4 cells/L³ with neutrophils 70% and lymphocytes 26%. CRP came down to 50mg/dl. ABG showed some improvement in oxygenation with pH: 7.48, PaO₂: 101mmHg, PaCO₂: 36mmHg, SO₂: 99%.

On 6th day, she showed significant clinical improvement in respiratory parameters. Her RR was 30-35breaths/minute. ABG showed significant improvement in oxygenation, pH: 7.45, PaO₂: 120mmHg, PaCO₂: 38mmHg. We reduced inspired oxygen concentration via HFND to 50%.

On 7th day patient's arterial blood gases revealed pH: 7.44, PaCO₂: 38mmHg and PaO₂: 118mmHg. Then HFND was replaced with 40% venturi face mask and as she was stable, sent to High Dependency Unit. She continued to recover and supplemental oxygen was tailed off. Oseltamivir was continued for 10 days and intravenous antibiotics for 14 days. During her hospitalization haemodynamic parameters, liver and renal functions were stable. She was discharged on the 22nd day with her newborn.

Discussion

Obstetric patients in the 2nd or 3rd trimester and who are 2 weeks or less post-partum are most at risk of developing complications of H1N1 virus infection including increased risk of hospital admission, ICU stay and death. Reported overall case fatality was less than 0.5% and approximately 9% -31% of hospitalized patients were admitted to an ICU, where 14% - 46% of died.²

Complications of H1N1 influenza infection includes severe pulmonary complications, bacterial co-infection, exacerbation of underlying chronic disease and miscellaneous conditions including myositis, rhabdomyolysis and central nervous complications. Pulmonary complications include severe hypoxemia and ARDS.³

This case report illustrates how non-invasive HFND gave good results in hypoxemic respiratory failure due to influenza H1N1 infection especially in the setting of possible unexpected infections and ventilator associated pneumonia. HFND has several physiological advantages over traditional oxygen therapy devices, including decreased nasopharyngeal resistance, washout of nasopharyngeal dead space, generation of positive pressure in the pharynx, increasing alveolar recruitment, humidification of airways, increased fraction of inspired oxygen and improved mucociliary clearance.^{4,5} HFND was also associated with a higher partial pressure of arterial oxygen (PaO₂) and lower respiratory rate.⁵

HFND is most suitable in conditions of hypoxemic non hypercarbic situations. These patients usually need high fractional inspired oxygen concentration with high inspiratory flow rates. Traditional conventional devices like nasal prongs, face masks can only provide maximum flow rates up to 15L/minute and fractional inspired oxygen

concentration not more than 40-55%. HFND can provide 100% humidified heated oxygen at a maximum flow rate of 60L/min.⁶ It is better tolerated and more comfortable compared to traditional methods.⁷

Although HFND is a supportive therapeutic technique, enhanced respiratory support with this novel device can save lives with very minimal complications.

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