SUCCESSFULLY SUPPORTED BY NONINVASIVE VENTILATION FOR H7N9 VIRAL PNEUMONIA WITH ACUTE RESPIRATORY DISTRESS SYNDROME: CASE REPORT

Hsiu-Feng Hsiao\textsuperscript{1,2}, Han-Chung Hu\textsuperscript{1,2,3}, Chang-Wei Lin\textsuperscript{3}, Chung-Shu Lee\textsuperscript{3}, Lan-Ti Chou\textsuperscript{1,2}, Chung-Chi Huang\textsuperscript{1,2,3}, Kuo-Chin Kao\textsuperscript{1,2,3}

Abstract

In March 2013, a novel avian influenza virus A (H7N9) emerged and caused severe illnesses, including pneumonia, acute respiratory failure, and acute respiratory distress syndrome (ARDS). Noninvasive ventilation (NIV) for severe hypoxic respiratory failure caused by influenza remains controversial. Furthermore, there is little information for NIV with H7N9 viral pneumonia complicated with ARDS.

A 40-year-old man suffered from fever and general malaise after returning to Taiwan from Kunshan, Jiangsu Province, China. He denied having any contact with sick people or animals during his travels. He ever visited a local medical department and Zanamivir inhalation was prescribed but in vain. Due to his persistent fever, dry cough and mild shortness of breath, he was referred to Chang Gung Memorial Hospital for admission. Initial throat swab tested negative for flu by real-time polymerase chain reaction. However, repeat sputum and throat swab specimens tested positive for H7N9. He was transferred to the intensive care unit due to progressive dyspnoea. CXR showed rapidly progressive bilateral pneumonia. PaO\textsubscript{2}/FiO\textsubscript{2} ratio was 112 mm Hg under FiO\textsubscript{2} 0.55. NIV was used for moderate ARDS. His PaO\textsubscript{2}/FiO\textsubscript{2} ratio improved after NIV use for 4 hours. Due to his symptom improving, NIV was changed to high flow mask and nasal cannula later. Follow-up sputum and throat swab specimens were negative for H7N9 and then he was transferred back to the ward and discharged on May 8.

Here, we report on a patient with H7N9 viral pneumonia with moderate ARDS for whom NIV was effective and obviated intubation.

Key Words: Noninvasive ventilation; H7N9 virus; Acute respiratory distress syndrome

Introduction

In March 2013, a novel avian influenza virus A (H7N9) emerged and caused severe illnesses, including pneumonia, acute respiratory failure (ARF), and acute respiratory distress syndrome (ARDS).\textsuperscript{1,2} Using non-invasive ventilation (NIV) has been shown to be effective for chronic ob-

Correspondence: Dr. Kuo-Chin Kao
Division of Thoracic Medicine, Chang Gung Memorial Hospital; 5, Fu Shing Street, Gueishan Shiang, Taoyuan 333, Taiwan\textsuperscript{1}
Phone:+ 886-3-328-1200 ext. 8468; Fax: +886-3-327-2474; E-mail:ckck0502@cgmh.org.tw
Department of Respiratory Therapy, Chang Gung Memorial Hospital, Taoyuan, Taiwan\textsuperscript{1}
Department of Respiratory Therapy, Chang Gung University College of Medicine, Taoyuan, Taiwan\textsuperscript{2}
structive pulmonary disease with acute exacerbation, cardiogenic pulmonary oedema and ARF in immunocompromised patients. However, some authors argued against using NIV for ARF as it may increase the risk of complications if intubation is delayed for hypoxemic patients with pneumonia. Using NIV for severe hypoxemic respiratory failure remains controversial for those patients affected by H1N1 viral infections. Furthermore, there is little information regarding a role for NIV with H7N9 viral pneumonia. Here, we report on a patient with H7N9 viral pneumonia with moderate ARDS for whom NIV was effective and obviated intubation.

Case Report

A 40-year-old Taiwanese man suffered from fever and general malaise after returning to Taiwan from Kunshan, Jiangsu Province, China on April 19, 2014. At first, he had no respiratory symptoms, gastrointestinal symptoms or myalgia. He denied having any contact with sick people or animals during his travels, although he had gone to live poultry markets on April 17. He had been otherwise well except for a history of urolithiasis.

He had sought medical attention on April 20 when his fever continued. Zanamivir inhalation (2 puff s, two times a day) was prescribed at a local medical department due to suspicion of flu virus infection. Due to his persistent fever, dry cough and mild shortness of breath, he was referred to Chang Gung Memorial Hospital, Linkou branch for admission on April 23.

An initial chest radiograph showed left lower lobe pneumonia with infiltration on April 23. Two throat swab specimens tested negative for flu subtypes by real-time polymerase chain reaction (PCR) on April 23 and 24. However, repeat sputum and throat swab specimens tested positive for H7N9 by real-time PCR on April 24 and 25. Zanamivir inhalation was discontinued and changed to oseltamivir (150 mg twice daily) due to his poor response. Levofloxacin was added to cover atypical pneumonia.

He was subsequently transferred to the medical intensive care unit due to progressive dyspnoea and for isolation. Follow-up chest radiographs showed rapidly progressive bilateral pneumonia in his lower lobes on April 24 (Figure 1A). Chest computed tomography scanning revealed bilateral lung parenchyma consolidation,

Fig. 1. A: CXR showed bilateral lower lobes pneumonia especially over left lower lobe. B: Chest computed tomography scanning revealed bilateral lung parenchyma consolidation, particularly in the gravity-dependent areas, which was compatible with ARDS.
particularly in the gravity-dependent areas, which was compatible with ARDS (Figure 1B). His PaO$_2$/FiO$_2$ ratio and alveolar-arterial oxygen difference (P(A-a)O$_2$) were, respectively, 112 mm Hg and 298 mm Hg under high flow mask with FiO$_2$ 0.55. Initially, NIV with settings for an inspiratory positive airway pressure of 17 cm H$_2$O and expiratory positive airway pressure of 10 cm H$_2$O was used for moderate ARDS.

His PaO$_2$/FiO$_2$ ratio and P(A-a)O$_2$ improved, respectively, to 131 mm Hg and 276 mm Hg after NIV use for 4 hours (Figure 2). Due to his improving clinical symptoms and signs, we changed NIV to intermittent use on April 27 with alternative high flow mask use and all day high flow mask use on April 29, and then changed to a nasal cannula at 4 L/min on May 2. Chest echograms showed no pleural effusion in both sides on May 2. Follow-up sputum and throat swab specimens were negative for H7N9 by real-time PCR on May 2 and April 3. He was then transferred back to the infectious disease ward in stable condition on May 6.

Discussion

A common feature of H1N1 critically ill patients is severe pneumonia and the development of ARDS characterized by severe hypoxemia and a requirement for mechanical ventilation support. For H1N1 pneumonia compatible with ARDS patients during the 2009 pandemic, a multicentre prospective cohort study showed that NIV was used for 49 (28%) patients on their admission, but failed for 94% of these patients. Thus, the European Respiratory Society and the European Society of Intensive Care Medicine recommended avoiding NIV use and intubating those patients infected with the new H1N1 virus strain with severe hypoxemia, rapidly developing ARDS, multiorgan failure and refractory hypoxia. Based on the management recommendations of SEMICYUC, NIV is not recommended for influenza A (H1N1) patients who require respiratory support due to the risk of aerosol generation and the poor clinical results.

However, recent data showed that the NIV success rate had increased in a subgroup of H1N1 patients who did not need immediate intubation for a life threatening condition. A prospective multicentre study done in Italy to assess the efficacy of NIV for H1N1 viral pneumonia with PaO$_2$/FiO$_2$ ratios of <300 showed that NIV could obviate intubation in 48% (47/98) of these patients.
patients. Hospital mortality was significantly lower for those patients with successful NIV compared to those with NIV failure (2.1% vs. 53.8%, P <0.001). A Simplified Acute Physiology Score II of >29 and a PaO$_2$/FiO$_2$ ratio of ≤ 127 at admission and PaO$_2$/FiO$_2$ of ≤ 149 after 1 hour of NIV were independent predictors for intubation. The authors concluded that early NIV application with the aim of avoiding intubation, rather than as an alternative, could reduce the intubation rate.

Additionally, the effects of NIV were assessed in a prospective, observational registry of H1N1 viral pneumonia patients in 148 Spanish intensive care units in 2009–10. NIV was successful for 72 patients (40.7%). Low Acute Physiology and Chronic Health Evaluation II scores, low Sequential Organ Failure Assessment scores and no renal failure were associated with NIV success. NIV success was independently associated with fewer than two chest X-ray quadrant opacities and no requirement for a vasopressor. For patients for whom NIV failed, the delay in intubation did not increase their mortality as compared with initially intubated patients (26.5% vs. 24.2%).

Among 139 patients with confirmed H7N9 virus infection, the rates of required mechanical ventilation and ARDS development were 61.5% (56/91) and 57.8% (48/83), respectively, and the overall hospital mortality rate was 33.8% (47/139). Among 111 H7N9 virus infection patients, 96 (86.5%) required mechanical ventilation and 79 (71.2%) had moderate-to-severe ARDS. Of the 96 patients who required mechanical ventilation, 65 (58.6%) required invasive mechanical ventilation and 31 (27.9%) received NIV. Among those patients with ARDS, 65 (82.3%) required invasive mechanical ventilation and 14 (17.7%) received NIV.

In conclusion, considering the high demand for intensive care beds during a pandemic, NIV may have a role for reducing this load. Substantial evidence supports the use of NIV for appropriately selected patients. NIV should be a part of the armamentarium for intensivists when managing acute respiratory failure.

References

非侵襲性呼吸器成功支持H7N9禽流感病毒引發的急性呼吸窘迫症候群：病例報告

蕭秀鳳1,2，胡漢忠1,2,3，林倡葦3，李忠恕3，周蘭娣1,2，
黃崇旂1,2,3，高國晉1,2,3*

摘要

2013年3月，新型禽流感病毒A（H7N9）的出現，造成了嚴重的疾病，包括肺炎、急性呼吸衰竭與急性呼吸窘迫症候群（ARDS）。非侵襲性呼吸器（NIV）的使用，在對於流感所造成的严重低血氧性呼吸衰竭的角色仍存在爭議。甚至，非侵襲性呼吸器使用於H7N9禽流感病毒性肺炎併發急性呼吸窘迫症候群的相關資訊也少見。

一名40歲的男性從中國江蘇省崑山市返台後，感覺全身不適和發燒而至地區醫院就醫，病人否認在旅途中曾與生病的人或動物有任何接觸，地區醫院先給予Zanamivir吸入治療，但情況並未好轉。由於持續發燒、乾咳與輕微呼吸急促，轉診至長庚醫院。最初的咽部拭子採樣對流感聚合酶鏈反應檢測為陰性。然而，重複的檢測痰液和咽部拭子標本對H7N9則呈陽性。由於出現漸進性呼吸困難，病人被轉入重症加護病房，胸部X光呈現快速進展的雙側肺炎，動脈血氧分壓/吸入氧分率（PaO2/FiO2）為112毫米汞柱。非侵襲性呼吸器於是先使用於此中度急性呼吸窘迫症候群的病人，病人的氧合狀態在非侵襲性呼吸器使用後4小時好轉，由於病人的症狀持續改善，之後改為高流量面罩和鼻導管，在後續H7N9的痰液和咽部拭子標本呈陰性，因此轉至病房照護並於5月8日出院。

一位H7N9禽流感病毒性肺炎合併中度急性呼吸窘迫症候群病人，成功的使用了非侵襲性呼吸器而避免了插管，非侵襲性呼吸器的使用在此病例是有效的。

關鍵詞：非侵襲性呼吸器，H7N9禽流感病毒，急性呼吸窘迫症候群