

Successful management of life-threatening respiratory failure from H1N1 influenza

Nawwar Al-Attar, Lila Bouadma, Haitham Altaani, Michel Wolff, Patrick Nataf

Nawwar Al-Attar, Haitham Altaani, Patrick Nataf, Department of Cardiac Surgery, Assistance Publique-Hôpitaux de Paris (AP-HP), Bichat Hospital, 75018 Paris, France

Lila Bouadma, Michel Wolff, Medical Intensive Care Unit, Assistance Publique-Hôpitaux de Paris (AP-HP), Bichat Hospital, 75018 Paris, France

Author contributions: All authors contributed equally to this work; Al-Attar N and Altaani H performed the ECMO procedure, collected and reviewed clinical information about the patient and wrote the report; Bouadma L and Wolff M were involved with daily care at the intensive care unit and assisted with report writing; Nataf P was consulted on management of the patient and assisted with report writing.

Correspondence to: Nawwar Al-Attar, PhD, Professor, Department of Cardiac Surgery, Assistance Publique-Hôpitaux de Paris (AP-HP), Bichat Hospital, 46 rue Henri Huchard, 75018 Paris, France. nawwar.al-attar@bch.aphp.fr

Telephone: +33-1402-57132 Fax: +33-1402-57229

Received: January 08, 2013 Revised: February 18, 2013

Accepted: March 9, 2013

Published online: March 28, 2013

Abstract

We report the outcome of a pregnant woman with a life-threatening acute respiratory distress syndrome from a novel influenza A (H1N1) virus infection 3 d postpartum successfully managed by veno-arterial extracorporeal membrane oxygenation. The patient was successfully weaned from extracorporeal membrane oxygenation (ECMO) on day 10. Novel H1N1 virus infection was identified by real-time reverse transcription-polymerase chain reaction. Veno-arterial ECMO in this patient carried a number of specific advantages namely maintaining haemodynamic stability obviating the need for inotrope support and improving oxygenation compared to alternative approaches such as veno-venous ECMO and pumpless devices. Femoral arterial and venous cannulae were inserted in a pure percutaneous method allowing rapid establishment of extracorporeal circulation. Given the high mortality of acute respiratory

distress syndrome following novel H1N1 virus infection, we advocate the use of ECMO when conventional mechanical ventilation fails.

© 2013 Baishideng. All rights reserved.

Key words: Respiratory failure; Influenza A; Extracorporeal membrane oxygenation; Pregnancy; Outcome

Core tip: Novel influenza A virus infection can result in acute respiratory distress syndrome extremely difficult to manage with conventional mechanical ventilation and non-invasive therapy. Veno-arterial extracorporeal membrane oxygenation can provide respiratory and circulatory support in these patients. We successfully weaned a postpartum patient after 10 d of extracorporeal membrane oxygenation. Furthermore, by employing the pure percutaneous method of cannulae insertion, we minimized implantation time and trauma.

Al-Attar N, Bouadma L, Altaani H, Wolff M, Nataf P. Successful management of life-threatening respiratory failure from H1N1 influenza. *World J Respirol* 2013; 3(1): 8-10 Available from: URL: <http://www.wjgnet.com/2218-6255/full/v3/i1/8.htm> DOI: <http://dx.doi.org/10.5320/wjr.v3.i1.8>

INTRODUCTION

Acute respiratory distress syndrome (ARDS) is a life-threatening complication of influenza. It has been reported after novel influenza A (H1N1) virus infection and is a major cause of death in these patients^[1]. The virus causes lung damage from direct injury to the respiratory epithelium and can be associated with secondary cytokine storm^[1]. The management comprises aggressive supportive care, with positive pressure ventilation and high oxygen concentrations. However, mechanical ventilation carries the risk of barotrauma and oxygen toxicity,

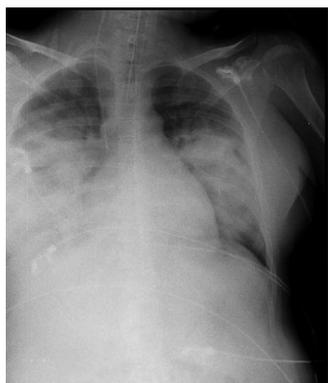


Figure 1 Chest-X ray showing bilateral infiltrates.

further aggravating lung injury^[2]. In a series of ARDS in patients with H1N1 virus infection, mortality among the patients requiring mechanical ventilation was 58%^[11] compared to 30% for other causes of ARDS. A number of adjuvant strategies have been employed for treatment of ARDS, and the use of extracorporeal membrane oxygenation (ECMO) has shown to reduce the ventilator-induced lung injury and mortality in certain patients^[3,4]. The outcome of ECMO has not been specifically reported in patients with ARDS secondary to novel H1N1 virus infection but can improve survival by 50% regardless of the etiology^[5,6].

CASE REPORT

A 41-year-old woman (para 5, gravida 2) was transferred from the department of obstetrics for acute respiratory distress 3 d following a normal vaginal delivery of a 37 wk term baby boy. The previous gynaecological, medical and surgical history were unremarkable. A few days before delivery she had fever (39 °C) and a flu-like illness. On the third post-partum day, the patient developed increasing dyspnoea. This was followed by severe hypoxemia, acute respiratory distress syndrome, and an inability to achieve adequate oxygenation with conventional ventilation modalities (SaO₂ < 90%, arterial pO₂ = 49 mmHg and pCO₂ = 29 mmHg). Her chest X-ray showed bilateral widespread alveolar infiltrates (Figure 1). She had a white cell count of 2.98 × 10⁹/L with predominant neutrophilia (88.6%) and lymphocytosis (10.1%), and C-reactive protein of 179 mg/L. She was transferred to the intensive care unit where orotracheal intubation and advanced mechanical ventilation (fraction of inspired oxygen of 1.0 and positive end-expiratory pressure of 15 cm H₂O including inhaled nitric oxide at 10 PPM) did not significantly improve the respiratory status (SpO₂ < 70%). Consequently, veno-arterial ECMO was established with an 18Fr cannula inserted into the right common femoral artery and a 22Fr venous cannula in the right femoral vein, associated with volume resuscitation. This led to reversal of hypercapnia and improved oxygenation.

The patient was successfully weaned from ECMO on day 10. Bacterial cultures of blood, urine and tracheal

aspirate were negative. Novel H1N1 virus infection was documented by testing of respiratory (bronchoalveolar lavage) specimens with real-time reverse transcription-polymerase chain reaction.

DISCUSSION

The patient was previously healthy and although pregnancy is known to increase the risk for influenza-associated morbidity and mortality during seasonal influenza epidemics^[7,8] and pandemics^[9,10], there seems to be a disproportionate increase in lethality for young, healthy individuals infected with HP strains of H1N1 viruses which correlates with a significant increase in the recruitment of inducible NOS-producing dendritic cells to the pneumonic lung, explaining the severity of the presentation^[11]. The Centers for Disease Control and Prevention have reported a total of 20 cases of novel H1N1 virus infection among pregnant women in the United States, of which one patient developed ARDS and died^[12]. In metropolitan France, 3 cases of infection in pregnant women were reported (out of a total of 921 confirmed or probable cases), none of which were associated with complications^[13]. The use of veno-arterial ECMO in this patient maintained hemodynamic stability obviating the need for inotrope support and is less cumbersome than venovenous ECMO. It was inserted in a pure percutaneous method using the Seldinger's technique allowing rapid establishment of extracorporeal circulation. After puncture of the vessel, a soft tipped guide-wire was passed through the needle. Dilators were passed stepwise over the guide-wire to enlarge the access until the cannula size was achieved. The cannula was inserted and connected to the ECMO system. Thus percutaneous femoral cannulation carries the advantage of allowing an expeditious procedure in an emergency situation^[14]. Because novel H1N1 virus infection complicated by ARDS is associated with a high mortality, ECMO should be considered when conventional mechanical ventilation fails.

REFERENCES

- 1 **Ng WF**, To KF, Lam WW, Ng TK, Lee KC. The comparative pathology of severe acute respiratory syndrome and avian influenza A subtype H5N1--a review. *Hum Pathol* 2006; **37**: 381-390 [PMID: 16564911 DOI: 10.1016/j.humpath.2006.01.015]
- 2 **Ware LB**, Matthay MA. The acute respiratory distress syndrome. *N Engl J Med* 2000; **342**: 1334-1349 [PMID: 10793167 DOI: 10.1017/S0265021508004870]
- 3 **Muellenbach RM**, Kredel M, Wunder C, Küstermann J, Wurmb T, Schwemmer U, Schuster F, Anetseder M, Roewer N, Brederlau J. Arteriovenous extracorporeal lung assist as integral part of a multimodal treatment concept: a retrospective analysis of 22 patients with ARDS refractory to standard care. *Eur J Anaesthesiol* 2008; **25**: 897-904 [PMID: 18662425]
- 4 **Rosamel P**, Delannoy B, Jault V, Metton O, Dubien PY, Flamens C, Bastien O. Refractory infectious ARDS: place of extracorporeal membrane oxygenation. *Ann Fr Anesth Reanim* 2008; **27**: 446-449 [PMID: 18436420 DOI: 10.1016/j.annfar.2008.02.007]
- 5 **Hemmila MR**, Rowe SA, Boules TN, Miskulin J, McGill-

- licuddy JW, Schuerer DJ, Haft JW, Swaniker F, Arbabi S, Hirschl RB, Bartlett RH. Extracorporeal life support for severe acute respiratory distress syndrome in adults. *Ann Surg* 2004; **240**: 595-605; discussion 605-607 [PMID: 15383787]
- 6 **Lewandowski K.** Extracorporeal membrane oxygenation for severe acute respiratory failure. *Crit Care* 2000; **4**: 156-168 [PMID: 11094500 DOI: 10.1186/cc689]
- 7 **Neuzil KM,** Reed GW, Mitchel EF, Simonsen L, Griffin MR. Impact of influenza on acute cardiopulmonary hospitalizations in pregnant women. *Am J Epidemiol* 1998; **148**: 1094-1102 [PMID: 9850132 DOI: 10.1093/oxfordjournals.aje.a009587]
- 8 **Dodds L,** McNeil SA, Fell DB, Allen VM, Coombs A, Scott J, MacDonald N. Impact of influenza exposure on rates of hospital admissions and physician visits because of respiratory illness among pregnant women. *CMAJ* 2007; **176**: 463-468 [PMID: 17296958 DOI: 10.1503/cmaj.061435]
- 9 **Freeman DW,** Barno A. Deaths from Asian influenza associated with pregnancy. *Am J Obstet Gynecol* 1959; **78**: 1172-1175 [PMID: 13824729]
- 10 **Harris JW.** Influenza occurring in pregnant women. *JAMA* 1919; **72**: 978-980 [DOI: 10.1001/jama.1919.02610140008002]
- 11 **Aldridge JR,** Moseley CE, Boltz DA, Negovetich NJ, Reynolds C, Franks J, Brown SA, Doherty PC, Webster RG, Thomas PG. TNF/iNOS-producing dendritic cells are the necessary evil of lethal influenza virus infection. *Proc Natl Acad Sci USA* 2009; **106**: 5306-5311 [PMID: 19279209 DOI: 10.1073/pnas.0900655106]
- 12 **Centers for Disease Control and Prevention (CDC).** Novel influenza A (H1N1) virus infections in three pregnant women - United States, April-May 2009. *MMWR Morb Mortal Wkly Rep* 2009; **58**: 497-500 [PMID: 19444154]
- 13 Bulletin Epidémiologique Hebdomadaire, Note Dit-InVS : décès A(H1N1) p2009. cited 2009-06-03. Available from: URL: http://opac.invs.sante.fr/doc_num.php?explnum_id=6403
- 14 **Roussel A,** Al-Attar N, Alkhoder S, Radu C, Raffoul R, Alshammari M, Montravers P, Wolff M, Nataf P. Outcomes of percutaneous femoral cannulation for venoarterial extracorporeal membrane oxygenation support. *EHJ: Acute Cardiovascular Care* 2012; **1**: 111-114 [DOI: 10.1177/2048872612449417]

P- Reviewers Kelesidis T, Matsumoto T, O'Connor T, Sancho-Chust JN, Stéphane V **S- Editor** Huang XZ
L- Editor A **E- Editor** Ma S

