

A case of ARDS due to adenoviral pneumonia

Abstract

The acute respiratory distress syndrome (ARDS) is characterized by a non-cardiogenic pulmonary edema with bilateral chest radiograph opacities and hypoxemia refractory to oxygen therapy. Adenovirus is a frequent cause of mild self-limiting upper respiratory tract infection, gastroenteritis, and conjunctivitis in infants and young children. Fatal infections (severe pneumonia progressing to respiratory failure, septic shock and/or encephalitis) are rare among immunocompetent adults. We report a case of twenty-two-years old pregnant woman who had severe adenovirus pneumonia. She presented with sudden onset of respiratory distress and progressed rapidly to respiratory failure. She was successfully recovered with supportive measures.

Keywords: acute respiratory distress syndrome; adenovirus; positive end-expiratory pressure; high-flow oxygen nasal cannula

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Introduction

The acute respiratory distress syndrome (ARDS) is characterized by a non-cardiogenic pulmonary edema with bilateral chest radiograph opacities and hypoxemia refractory to oxygen therapy. ARDS is an acute, diffuse, inflammatory lung injury that leads to increased pulmonary vascular permeability, increased lung weight, and a loss of aerated tissue. The pathological hallmark is diffuse alveolar damage (i.e., alveolar edema with or without focal hemorrhage, acute inflammation of the alveolar walls, and hyaline membranes). It is a common cause of admission to the intensive care unit (ICU) due to hypoxemic respiratory failure requiring mechanical ventilation. The severity of the hypoxemia defines the severity of the ARDS. Mild ARDS exists when the $\text{PaO}_2/\text{FiO}_2$ is > 200 mmHg, but ≤ 300 mmHg, on invasive or non-invasive ventilator settings that include a positive end-expiratory pressure (PEEP) or continuous positive airway pressure (CPAP) ≥ 5 cm H_2O . Moderate ARDS exists when the $\text{PaO}_2/\text{FiO}_2$ is > 100 mmHg, but ≤ 200 mmHg, on ventilator settings that include a PEEP ≥ 5 cm H_2O . And, severe ARDS exists when the $\text{PaO}_2/\text{FiO}_2$ is ≤ 100 mmHg on ventilator settings that include a PEEP ≥ 5 cm H_2O .¹ Adenoviruses are a family of DNA viruses. They are most commonly associated with upper respiratory tract syndromes such as pharyngitis or coryza but they can cause pneumonia as well. Adenovirus infections can be identified using viral culture, direct antigen assay or polymerase chain reaction. Appropriate specimens include nasopharyngeal aspirate or swab, throat swab, sputum sample, and bronchoalveolar lavage fluid.^{2,3} In immunocompetent adults, adenoviral pneumonia presents with respiratory illness that progresses rapidly to respiratory failure and often requires mechanical ventilation. We report a case of severe adenovirus pneumonia in previously healthy and immunocompetent woman, which had progressed to respiratory failure requiring mechanical ventilation. After the treatment and supportive measures, she recovered successfully.

Case presentation

Twenty two-years-old, prim gravid, 9 weeks pregnant woman was applied to a local hospital complaining of fever and progressive

shortness of breath for the last 8 hours. She was initially treated for suspected urinary tract infection. On obstetric examination, intrauterine ex fetus was detected and curettage was performed. She was transferred to our ICU for respiratory failure and hypoxemia. She had 4 gestations and 3 abortions on her medical history. Physical examination findings were as followed; body temperature was 36, 6°C, pulse rate was 126 beats per minute and blood pressure was 165/98 mmHg. Her respiratory rate was 40 breaths per minute with oxygen saturation of 54% on room air. Her Glasgow Coma Scale (GCS) was 15. In chest auscultation, there were inspiratory-expiratory coarse crackles and expiratory rhonchus on both hemi thoraxes. Non-invasive mechanical ventilation (NIMV) was applied. Following arterial blood gas (ABG) test with a fraction of inspired oxygen (FiO_2) of 70% and PEEP of 8 cm H_2O , resulted as: pH 7.33, PaCO_2 of 28 mm Hg, PaO_2 of 52 mmHg, HCO_3^- of 14 meq/L and SaO_2 of %87. Bilateral infiltrations were notable on chest x-ray, especially at the middle and lower zones (Figure 1). The $\text{PaO}_2/\text{FiO}_2$ score was < 100 , compatible with severe ARDS. The bedside ECHO showed normal right - left ventricles. She was intubated and connected to protective mechanical ventilation. She was ventilated with pressure controlled synchronous intermittent ventilation (P-SIMV) mode with rate of 14 bpm, PEEP of 14 cm H_2O , pressure support (PS) of 14 cm H_2O , FiO_2 of 1. Control ABG result was as followed: pH:7,39, PaCO_2 of 32 mmHg, PaO_2 of 80 mmHg, SaO_2 of 95% and HCO_3^- of 19 meq/L. Oseltamivir (150 mg/d) was administered by nasogastric tube and intravenous piperacillin-tazobactam, vancomycin were started as empirical treatment. She was sedated intermittently with propofol, midazolam and remifentanyl infusions. Noradrenalin infusion was needed at the initial hours of admission, because of a hypotensive episode which did not respond to fluids. Bacterial cultures of blood, urine, and tracheal aspiration were negative. Tracheal aspiration was negative for H1N1 infection but it was positive for adenovirus by polymerase chain reaction (PCR). We administered 1 mg/kg/day of methylprednisolone (60 mg per day) for 4 days and the dose was gradually reduced in 9 days. She was self-extubated on the fifth day of admission. She was initiated on NIMV with an expiratory/inspiratory positive airway pressure of 8/13 cm H_2O with a FiO_2 of 0.3 and high flow oxygen with nasal cannulae

(Flow: 40 lt/minute and FiO_2 of 0,35) for one day. On the following days, she was administered only high-flow oxygen nasal cannulae (HFNC) for four days. The clinical and radiological improvement was established (Figure 2). The patient was transferred to the department of pulmonary medicine on the tenth day of admission and discharged two days later.



Figure 1 The chest x-ray on admission.



Figure 2 The control chest x-ray.

Discussion

Adenovirus is an uncommon cause of community acquired pneumonia (CAP) (2%) in non-military immunocompetent hospitalized adults and is responsible for 15% of CAP.⁴ CAP in immunocompetent adult civilians presents as a non-specific febrile respiratory illness that progresses rapidly to respiratory failure and often requires mechanical ventilation.⁵ Outbreaks of adenovirus infection in long-term nursing facilities and in hospital wards with associated cases of fatal pneumonia have also been described. Respiratory failure developed in five patients. Four patients developed diffuse pulmonary infiltrates and met criteria for ARDS and required high FiO_2 , PEEP and paralysis to maintain adequate oxygenation. Septic shock developed after the onset of respiratory failure in each patient with ARDS.⁶

For all patients with ARDS, the recommendation is strong for mechanical ventilation using lower tidal volumes (4-8 ml/kg predicted body weight) and lower inspiratory pressures (plateau pressure < 30cm H_2O). For patients with severe ARDS, the recommendation is strong for prone positioning for more than 12 h/d). For patients with moderate or severe ARDS, the recommendation is strong against routine use of high-frequency oscillatory ventilation and conditional for higher positive end-expiratory pressure and recruitment maneuvers.^{1,7} There are no controlled trials and few clinical experiences using NIMV to manage patients with ARDS. NIMV may be reserved for the occasional patient with ARDS who is hemodynamic ally stable, is easily oxygenated, and does not need immediate intubation.

In a small (n = 40) trial Zhan et al.⁸ randomly assigned patients with ARDS to receive either NIMV or high concentration supplemental oxygen. Patients receiving NIMV were more likely to have improvement of $\text{PaO}_2/\text{FiO}_2$ and less likely to require intubation (4.8 versus 36.8 percent).⁸ In one trial, 105 patients with acute hypoxemic respiratory failure of varying etiologies were randomly assigned to receive standard medical therapy alone or NIMV plus standard medical therapy. NIMV decreased ICU mortality (18 versus 39 percent) and the intubation rate (25 versus 52 percent).⁹

HFNC can oxygenate patients as well as provide a small amount of positive airway pressure and reduce dead space such that it is thought to be a method of delivering noninvasive ventilation. In one meta-analysis of six randomized trials that examined HFNC for the treatment of acute respiratory failure (due to medical conditions [two trials], following extubation [three trials], and during bronchoscopy [1 trial]), HFNC was associated with a lower rate of intubation, when compared with conventional oxygen (12 versus 25 percent) but no difference when compared with NIV (18 versus 23 percent).¹⁰

Conclusion

Viral pneumonia should always be considered in differential diagnosis of the etiology of ARDS in young and/or immunosuppressed patients. Appropriate samples for etiological diagnosis should be taken as soon as possible. Early antiviral treatment and protective mechanical ventilation support provide positive results. We present our case to demonstrate the efficacy of protective mechanical ventilation, high PEEP, and high-flow oxygen nasal cannula in the treatment of severe ARDS due to adenoviral pneumonia.

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Conflicts of interest

Authors declare no conflict of interest exists.

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