Introduction

Surfactant therapy of ALI and ARDS has been studied for more than 30 years (Leyden 1947, Spragg 1989). The basic mechanism of surfactant replacement therapy is based on the following facts:

- High efficiency of surfactant therapy for ICM is reviewed
- Surfactant deficiency is long lasting
- High efficiency of surfactant treatment in experimental animals with ALI induced by different, diverse factors.

Several classic studies of the use of surfactant formulations for ARDS showed that this approach allows to soften CMV parameters, reduce the period of CMV and reduce mortality risk (Spragg 1989, Weil 2004, Willumsen 1998, Bautin 2002).

Surfactant-BL is a surfactant formulation produced in Russia and approved by Russian health authorities for ARDS therapy in 2005. Many clinical trials confirmed that among clinical trials demonstrated that: (1) its use in severe respiratory failure (Spragg 1989) and treatment of ARDS leads to 90% survival in patients with severe lung injury and 70-75% survival in patients with moderate lung injury (Spragg 2004; Unsell 2003; Rosenberg 2004). The formulation has been successfully used for 6 years (for more than 1,000 patients with acute respiratory distress syndrome (ARDS), severe burns, severe burns of airways, massive hemorrhage, expiratory or inspiratory complications after open heart surgery and trauma (Bautin et al. 2004; Rosenberg et al. 2001; Rosenberg 2004). Following this experience Surfactant-BL was used for A/H1N1 severe pneumonia and ARDS treatment during the first epidemic wave of A/H1N1 in Russia in October-December of 2009.

The purpose of the study was to estimate surfactant therapy efficiency in complex treatment of severe pneumonia and ARDS caused by A/H1N1 virus.

Methods

Study included 60 mechanically ventilated patients aged 18 to 59 (31 of them were pregnant or parturient women, 9 patients had obesity of III-IV degree, 10 patients had heart disease, 6 patients had bronchial asthma, 3 patients had diabetes, 1 patient had chronic kidney disease). All patients had severe bilateral confluent pneumonia and ARDS caused by A/H1N1 virus. The diagnosis was confirmed by serological history, clinical, X-ray and morphological findings as well as PCR. The patients were divided into 2 groups. The Group I included 31 patients, among them 12 pregnant or parturient women. The patients of this group had respiratory acidosis (3 patients), bronchopneumonia (2 patients), Bacteremia (5 patients), a dose of 150-250 mg twice a day for 3-5 days (mean dose for pneumonia patients), then 100 mg twice a day for 3-5 days for the patients of Group I and 125 mg twice a day for 3-5 days for the patients of Group II (10 patients).

Results and Discussion

All patients had severe pneumonia. On hospitalization they were immediately referred to ICU. The patients had prolonged duration of mechanical ventilation (MD of A/H1N1 pneumonia was 10.8±3.8 days, MD of ARDS was 15.3±3.5 days). The patients had severe pneumonia and ARDS without vertical treatment of severe pneumonia and ARDS. During the first 3 days patients had severe pneumonia and ARDS were on mechanical ventilation with high flow positive end-expiratory pressure and high dose of different respiratory agents and muscle relaxants (sedatives, anesthetics, neuromuscular blockers). Muscle relaxants were used because of high level of PEEP. The applied CMV parameters could not keep oxygenation level at PaO2 ≥60 mm Hg. Tracheotomy was carried out in the 1st day. On the 4-5 day majority of patients manifested signs of secondary bacterial infection (purulent exudate from bronchial, microaspiration data). Broad spectrum antibiotics were used to fight the infection. The patients experienced leukopenia and lymphopenia. Systemic parameters did not lower than 35-40 mm Hg of X-ray data proved that all the patients had severe pneumonia and ARDS.

The initial PaO2/FiO2 ratio for the patients of Group I was 112.9±2.1 (lg, 6-8 hours after the first Surfactant-BL administration at a dose of 150 mg (2.5-3 mg/kg), lung function improving from 120-150 mm Hg (increasing by 100-150%), on the average up to 223.2±7.2 mmHg (lg =0.001). The improvement of oxygenation was expressed as: PaO2/FiO2 ratio at 150 mg/kg improved from 120-150 mm Hg to 223.2±7.2 mm Hg during the first 24 hours. To keep level of oxygenation improvement in the patients with secondary bacterial infection, PEEP was increased from 10-12 cm H2O (lg =0.001).

Surfactant-BL administration was carried out as early as possible, during the first days of admission, the oxygenation showed efficiency when it was used simultaneously with other ICM treatments, in the first 1-3 days of A/H1N1 pneumonia.

The initial PaO2/FiO2 ratio for the patients of Group II when they were transferred to CMV was 137.2±8.5 mm Hg. During the first day of CMV PaO2/FiO2 ratio went up to 170.4±5.3 mm Hg (increasing by 22.7%, p<0.05). In this group (46.5%) rate of 22 patients died. Survived patients from this group received CMV treatment during 29-32 days (p<0.001). The comparison of PaO2/FiO2 ratio dynamics between both groups of patients is shown in Fig. 1. Two case numbers of the patients of Group I are presented as illustration.


Conclusion

1. Surfactant therapy together with antiviral and respiratory therapies in complex treatment of pneumonia and ARDS caused by A/H1N1 virus is very efficient, enabling to reduce CMV parameters quickly (during 1-2 days), reduce CMV duration and decrease significantly (10 times) mortality rate from ARDS.

2. Early (on the first day of respiratory failure development) inhalation of Surfactant-BL at a dose of 75 mg per administration, 2 times a day together with antiviral therapy leads to fast pneumonia resolution and prevents ARDS development. This therapy enables to avoid invasive lung CMV.

Surfactant therapy in complex treatment of pneumonia and ARDS caused by A/H1N1 virus also proved efficient when Surfactant-BL was introduced into the treatment later, on the 1-3 day of CMV.