POSTPERFUSION LUNG SYNDROME FOLLOWING CORONARY ARTERY BYPASS GRAFTING

SHI-MIN YUAN1, CHANG-XIAN XU2
1Department of Cardiothoracic Surgery, The First Hospital of Putian, Teaching Hospital, Fujian Medical University, 2Chang-Xian Xu, MD, PhD, Department of Cardiovascular Surgery, The Second Hospital of Shandong University

ABSTRACT

The postperfusion lung syndrome is an uncommon event after open-heart surgery. However, the timing of tracheal extubation after the operation remains controversy. A 58-year-old female patient underwent coronary artery bypass grafting. She developed postperfusion lung syndrome after the operation. In spite of stable cardiopulmonary condition, her arterial oxygen saturation (SaO2) and partial pressure of oxygen (PaO2) were low. After 42 hours’ intubation, she was successfully weaned and extubated. She was doing well after the operation. Patients with postperfusion lung syndrome may benefit from early extubation after the operation. Moreover, non-invasive ventilation support can be useful, if necessary, to the respiratory management.

Key words: Coronary artery bypass, Heart-lung machine, Lung injury, Ventilation.

Received September 30, 2012; Accepted October 11, 2012

Introduction

The postperfusion lung syndrome is an uncommon event after open-heart surgery with an incidence of 1-2% (1). In spite of the development of minimally invasive surgery and off-pump coronary artery bypass techniques, pulmonary complications remain a leading cause of early postoperative morbidity and mortality (2). On the one hand, general anesthesia, thoracotomy and sternotomy may inevitably cause respiratory function impairment; on the other hand, aged patients suffering of several lung diseases [asthma, emphysema, chronic obstructive pulmonary disease (COPD) or pulmonary artery hypertension, etc.] may exacerbate the pulmonary complications (2).

Cardiopulmonary bypass leads to systemic inflammatory response, which might cause pulmonary, renal, gut, central nervous system, and myocardial dysfunction, as well as coagulopathy, changes in vascular tone and permeability (vasoconstriction, vasodilatation and capillary permeability increase); interstitial fluid gathering, hemolysis, pyrexia, leukocytosis and increased susceptibility to infections (3). When this pathological course progresses prevailing with an acute lung inflammation, it is called postperfusion lung syndrome (4). Even though the treatment strategies for this syndrome have been described, the timing of tracheal extubation remains controversy. This article aims to discuss this topic in connection with a recent case.

Case report

A 58-year-old female patient was admitted to the Department of Cardiology due to exertional chest distress for 20 years. She had a history of hypertension and stroke. When she was admitted, her blood pressure was 160/100 mmHg. Physical examination revealed no râles over both lungs. Her heart rate was 68 beats/min, no heart murmur was audible. Electrocardiogram revealed depressed S-T segment in I, aVL, and V4-6 and inverted T waves in V4-6.
Chest X-ray showed clear lung fields (Fig. 1). She was diagnosed of old myocardial infarction, acute coronary syndrome, primary hypertension, and cerebral infarction. She received coronary angiography which showed a diffuse stenosis of the left anterior descending coronary artery (LAD) 60-80% and the first diagonal branch 70% (Fig. 2A), and mid-right coronary artery 90% (Fig. 2B).

She underwent coronary artery bypass with the left internal mammary artery grafted to the LAD, and a saphenous vein grafted sequentially to the first diagonal branch and the posterior descending artery. The bypass time was 102 min and the crossclamp time was 72 min. Prebypass blood-gas analysis revealed arterial oxygen saturation ($SaO_2$) was 91% and partial pressure of oxygen ($PaO_2$) was 64 mmHg.

At 8:30 AM of the first day after the operation, the module of the ventilator was changed into continuous positive airway pressure (CPAP), positive end-expiratory pressure (PEEP) was decreased from 8 to 2 cmH$_2$O, fraction of inspiration oxygen ($FiO_2$) to 40%, and the $SaO_2$ was kept at 87%.

At 9 o’clock, the mechanical ventilator was weaned from the patient, inspired with high concentration of oxygen (5 L/min), and the $SaO_2$ of the patient was kept at 82-83%. $PaO_2$ was 51 mmHg. Meanwhile, the patient had a stable blood pressure 122/70 mmHg. She complained no respiratory symptoms. The patient was conscious and demanded extubation by shaking her head; however, this was refused due to a $SaO_2$ of 85%, according to the extubation guide line in intensive care unit (ICU). She was given sediment and the module of the ventilator was changed back into PEEP 6, synchronized intermittent mandatory ventilation (SIMV) 10, and $FiO_2$ 60%. The patient’s temperature was normal, and no râles were audible. Routine examination of serum electrolytes and proteins proved within the normal range. Chest X-ray revealed small patchy shadows over both lungs (Fig. 3), suggesting a diagnosis of postperfusion lung syndrome.

Till then, she was intravenously infused 310 ml, and her urinary output was 280 ml. She thus received intravenous furosemide and high doses of methylprednisolone. She was stable and the $SaO_2$ was 86-88% with intubation on the second day. She was successfully weaned and further extubated, keeping her $SaO_2$ around 85-94% with low flow oxygen by nasal cannula. Non-invasive ventilation was not needed. The ventilatory support time was 42 hours. Since then, she had an uneventful course, and was discharged home 11th day after the operation.

**Discussion**

Postperfusion lung syndrome is a breathing complication developed within hours of cardiac operation performed with the aid of cardiopulmonary bypass. The pathophysiological changes may include ventilatory alcalosis, hypocapnia, hypoxemia and the rise in the alveolar arterial oxygen gradient is increased during the second postoperative day$^{[5]}$. Mitochondrial and lamellar body damages and endothelial and alveolar swelling were major observations following cardiopulmonary bypass under an electron microscope$^{[6]}$.

Postperfusion lung syndrome seems to be related to the types of oxygenator used in the cardiac surgery, as early clinical observations showed that Travenol bubble oxygenator use may lead to
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more severe pulmonary injury than with a membrane oxygenator\(^7\). Age of patients, severity of disease, preoperative pulmonary function, prolonged duration of extracorporeal circulation and myocardial ischemia have been proved to be predisposing factors responsible for postoperative cardiopulmonary morbidities\(^8\).

Patients with this syndrome may present with constitutional symptoms including weakness, anorexia, fever, hypoventilation except for breathing problems like shortness of breath\(^9\).

Apart from the usual management strategies, to treat the downstream, neutrophil-derived effectors was proved to be an alternative way of therapy\(^10\).

Invasive mechanical ventilation is associated with several complications, and the return to spontaneous ventilation has many physiological benefits. Therefore, early weaning and extubation have been proposed following trauma control surgery for these well-known reasons in particular in those patients with stable cardiopulmonary conditions [11]. Protracted ventilatory support may cause mechanical damage to the patient's respiratory tract and may shatter the patient's immunity leading to infections and multiple organ dysfunctions. If hypo-oxygenation occurs after extubation, non-invasive ventilation support can be useful to the respiratory management.

In conclusion, patients with postperfusion lung syndrome may benefit from early extubation after the operation. Non-invasive ventilation support can be useful, if necessary, to the respiratory management.

References