

## Case report

# Prone position for management of refractory hypoxaemia in a patient with single lung

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### Abstract

Prone position ventilation is widely used in treating patients with acute respiratory distress syndrome (ARDS) and severe refractory hypoxaemia. However, its use in patients who have undergone pneumonectomy is rare. We report a 57-year-old woman, a case of right pneumonectomy, who later presented with left lung pneumonia. She was ventilated with conventional lung protective strategy to improve oxygenation. When unsuccessful, ventilation in prone position was carried out. This case report gives you a sequential representation of how she was treated successfully for severe refractory hypoxemia with prone position ventilation.

**Keywords:** Pneumonectomy, acute respiratory distress syndrome, prone position ventilation, recruitment manoeuvres, refractory hypoxemia, a high flow humidified oxygen therapy device.

### Introduction

Prone position ventilation (PPV) is increasingly used in patients with acute lung injury (ALI)/acute respiratory distress syndrome (ARDS). Advantages of prone position ventilation in improving oxygenation and protection against ventilator induced lung injury (VILI) are suggested but not well-established. However, three out of four recent meta-analysis do not rule out a possible beneficial effect of this therapy.<sup>1,2</sup> Prone position ventilation improves ventilation perfusion ratio, prevents cardiac compression on the lung and possibly reduce cephalad movement of the diaphragm to advocate a more uniform lung aeration. Patients with “recruitable lung” achieve more homogeneous

ventilation with lower levels of PEEP during prone position ventilation.<sup>3</sup>

The management of postpneumonectomy patient in respiratory failure is primarily supportive and it includes mechanical ventilation, early detection and treatment of infections.<sup>4</sup> Strategies such as prone position ventilation, extracorporeal circulatory support and high frequency ventilation are salvaging therapeutic options during crisis.<sup>5</sup> The only case report so far reported on successful prone position ventilation in a post pneumonectomy patient was in a 53 year old patient with malignant pleural mesothelioma who was put prone postoperatively and ventilated in Chile.<sup>6</sup> Although PPV has been used for resective thoracic surgery, the only information available on PPV postpneumonectomy comes from experimental studies.<sup>7</sup> Prone position ventilation due to pneumonia in a post pneumonectomy patient has not been reported so far.

### Case Report

A 57-year-old woman who had previously undergone right pneumonectomy for tubercular bronchiectasis

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was admitted to our ICU with respiratory failure. She was treated for hypertension, hyponatraemia and iron-deficiency anaemia during admission for pneumonectomy. Present admission was with lower respiratory tract infection with a one-week history of cough with expectoration, scanty mucoid sputum production and breathlessness. Patient was drowsy but arousable on arrival. In casualty, she was connected to 60% oxygen by venturi mask and an O<sub>2</sub> flow of 15 L/min. Her chest X-ray showed left lung haziness with pulmonary infiltrates (*Figure 1*).



**Figure 1:** Chest X-ray showing left lung haziness with pulmonary infiltrates.

Noninvasive ventilation (NIV) using ResMed Sullivan® VPAP® II was commenced immediately. She was put on spontaneous/time (S/T) mode with an IPAP of 16 cm H<sub>2</sub>O, EPAP of 8 cm H<sub>2</sub>O, FiO<sub>2</sub> of 0.6 and rate of 15/min. An arterial blood gas was done after two hours on NIV (*Table 1*). She was continued on the same settings for a day. By next day morning, she developed signs of oliguria, hypertension, abdominal distension, facial puffiness and pitting pedal oedema. She became drowsy and lethargic and was maintaining 60% SpO<sub>2</sub> on NIV. She was intubated orally with a 7.5 mm ID cuffed oral endotracheal tube and ventilation was started on pressure control SIMV mode with FiO<sub>2</sub> of 1.0. Post intubation ABG done is depicted in *Table 1*. Recruitment manoeuvres were attempted but did not show any improvement in oxygen saturation. Soon after which she developed an episode of bradycardia. She was resuscitated within a minute successfully. Chest X-ray was taken to rule out pneumothorax

**Table 1:** Important arterial blood gas reports in the course of her hospital stay.

	pH	PaO <sub>2</sub> /FiO <sub>2</sub>	PaCO <sub>2</sub> (mm Hg)	HCO <sub>3</sub> <sup>-</sup> (mmol/L)
On admission 60% oxygen Venturi 15 l/min O <sub>2</sub> flow	7.251	214/0.6 = 356	77.9	28.8
On NIV	7.213	149/0.6 = 248	90.3	29.4
Before intubation	7.20	74/1.0 = 74	108	41.1
Before proning	7.156	59/1.0 = 59	127	43
After 18 hours on proning	7.280	91/1.0 = 91	101	39
On supine	7.401	104/0.6 = 173	70	36

(*Figure 2*) and Doppler ultrasound of the lower limbs was negative for DVT. Echocardiogram showed a systolic pulmonary artery pressure of 26 mm Hg with no signs of right ventricular dysfunction and a left ventricular ejection fraction of 66%.

In view of hypoxia and hypoventilation, it was decided to prone and ventilate the patient. Recruitment manoeuvre was done with the patient in prone position. Mechanical ventilation in prone position was continued for 18 hours. Significant progressive improvement in oxygenation was noted. Chest X-ray was taken which showed clearing of left lung fields (*Figure 3*). At all times protective ventilatory strategy (low tidal volumes 6 ml/kg of ideal body weight and



**Figure 2:** Chest X-ray done before proning to rule out pneumothorax.



**Figure 3:** Chest X-ray done after proning for 18 hours.

a plateau pressure of 30 cm H<sub>2</sub>O) was ensured. After 18 hours of prone position ventilation, the FiO<sub>2</sub> was reduced gradually to 0.35, and was ventilated supine on pressure regulated volume control mode (PRVC) and pressure controlled synchronised intermittent mandatory ventilator (PC-SIMV) using Datex Ohmeda, Datex Ohmeda Medical Inc., USA.

She was tracheostomised on 12<sup>th</sup> day of invasive mechanical ventilation. Subsequently she was weaned off the critical care ventilator and connected to AIRVO™ Fisher & Paykel Healthcare - a high flow humidified oxygen therapy device. She did well with this device from which she was eventually weaned off. After 30 days of ICU stay, she was shifted to ward and managed with minimal, intermittent ventilatory support using portable NIV machine for another month. She was eventually sent home with oxygen and nocturnal NIV after more than two months of hospital stay.

## Discussion

Although falling, the mortality and morbidity associated with pulmonary resection remain significant, despite advances in surgical technique, anaesthetic management and postoperative care. Studies that used the American-European consensus conference definitions for ALI/ARDS have reported an overall prevalence rate of 2.2 to 4.2% in patients who have undergone lung resection. The mortality rate from ALI/ARDS in these patients ranged

from 52 to 65%.<sup>8</sup> Patients with ALI and ARDS require ventilatory assistance, usually escalating to intubation and mechanical ventilation. Despite intensive treatment the mortality is high, and patients generally die with multisystem organ failure. ARDS is now recognized to be a multisystem disease in which the lung is the most vulnerable organ, and the one, which usually heralds the onset of this condition.<sup>9</sup>

This case report highlights the impact of early prone ventilation on improving oxygenation with lung protective strategies in ARDS refractory to conventional methods of ventilation including recruitment maneuvers. Many studies on prone ventilation have not shown mortality benefit in ARDS even though they have shown improvement in oxygenation.<sup>10,11</sup> One possible explanation for this would be trying prone ventilation at late stages of ARDS. In our case report, early prone ventilation was used as a lung protective strategy since conventional modes of ventilation and recruitment manoeuvre failed to show improvement. Since our patient had left lung ARDS, the release of weight of the heart from the lung in prone position could have benefited in recruiting the lung better. The high adaptability of long-term ventilation patient on a high flow humidified oxygen therapy device during weaning is yet to be studied and established.

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