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Case Report

A Unique Technique of External Chest Compressions Synchronised with Suction to Clear an Occluded Main Bronchus

Saad Gomaa*

Consultant Anaesthetist, Hinchingbrooke Hospital, Huntingdon, Cambridgeshire, UK

**Corresponding author: Saad Gomaa, Consultant Anaesthetist, Hinchingbrooke Hospital, Huntingdon, Cambridgeshire, UK, Tel: 0044 7815054359; E-mail: smgomaa@hotmail.com*

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Abstract

Both positive pressure ventilation via endotracheal intubation and non-invasive ventilation are established modes of ventilation support for the treatment of respiratory failure. The choice depends on the overall clinical status of the patient. The British Thoracic Society has set criteria for the choice and application of non-invasive ventilation in 2002 [1]. The application of Bi-level Positive Airway Pressure (BiPAP) as a mode of ventilation support is an effective and popular option [2]. However, there are numerous complications associated with these techniques [3,4].

This case report describes an unreported rare complication during BiPAP supportive ventilation where the left main bronchus was occluded with blood clots, and the application of a unique technique to clear the obstructed bronchus in order to restore effective ventilation to that lung.

Keywords: Haemoptysis; Acute respiratory failure; Lung collapse; BiPAP; Cardiac arrest; Resuscitation; Bronchial Obstruction; Bronchoscopy

Case Report

An 82 years old lady presented to the Emergency Department (ED) with severe shortness of breath, frequent coughing, episodes of haemoptysis and air hunger.

Her past medical history revealed that she is an ex-smoker, suffering from hypertension and Parkinsonism that were both well controlled by medication. Over the preceding few years she had progressively lost weight, although this had settled at 40 kg for the last two years. Regular medical consultations, laboratory tests and a CT scan of her chest and abdomen two years previously were all clear. However, the CT did show hyperinflation of the lungs and she was diagnosed with mild emphysema; there was no history of asthma or chronic obstructive airway disease.

General examination performed on arrival to the ED showed that she had a Glasgow Coma Scale (GCS) score of 10/15 and she was apyrexial. However she was tachypnoeic, 28-32 respirations/minute, tachycardic at a rate of 110 beats/minute and with a blood pressure of 180/105 mmHg. Chest auscultation showed good air entry on both sides with a few added scattered crackles on both sides posteriorly, which were more audible on the right side. Arterial blood gases (ABGs) on admission are shown in table 1.

Emergency treatment was commenced in the ED with oxygen supplementation, salbutamol and atrovent nebulisers, fluid resuscitation and antibiotics.

The initial chest x-ray (CXR) was unremarkable apart from prominent parahilar shadows and enhancement of the broncho-vascular markings on the right side of the chest (Figure 1).

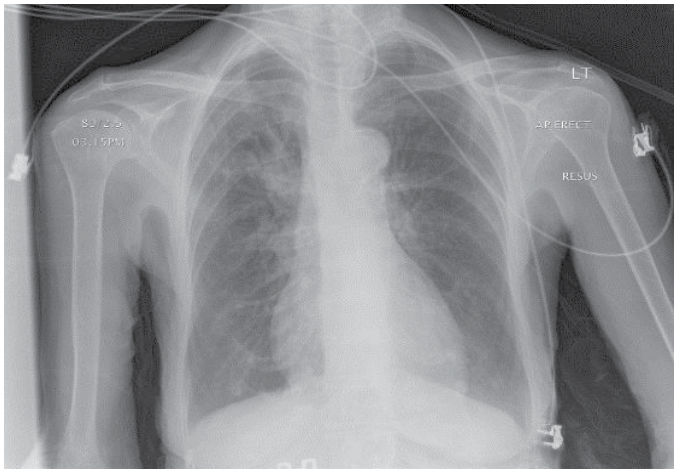

Figure 1. CXR on admission to ED.

The patient was then transferred to the respiratory ward for BiPAP supportive ventilation with pressure of 14/8 cmH2O and backup rate of 12 breaths/minute. She showed fluctuations in her levels of oxygenation and carbon dioxide accumulation as shown in table 1 which correlated to the changes in the level of consciousness.

Five hours after admission to the ward and whilst on the BiPAP machine, she developed sudden collapse and loss of consciousness. ABGs showed severe hypoxia and respiratory acidosis. The patient was sedated and the trachea was intubated to facilitate mechanical ventilation and transfer to the Intensive Therapy Unit (ITU) for further management. Unfortunately, during intubation by the attending trainee, she developed an episode of severe bradycardia and cardiac arrest which immediately responded to resuscitation with external cardiac compressions and administration of atropine and epinephrine. She required cardiovascular support through a noradrenalin infusion. In the ITU her oxygenation was still very poor despite providing 100% oxygen and using different modalities of mechanical ventilation.

Clinical examination revealed severe intercostal recession on the left side of the chest, absent breath sounds denoting no air entry and dull notes on percussion on the same side. The right side of the chest was significantly hyper-inflated. A second CXR (Figure 2) showed complete opacity in the left lung field, narrowing of the intercostal spaces, which were consistent with collapse and consolidation in the left lung with a shift of the mediastinum to the same side.

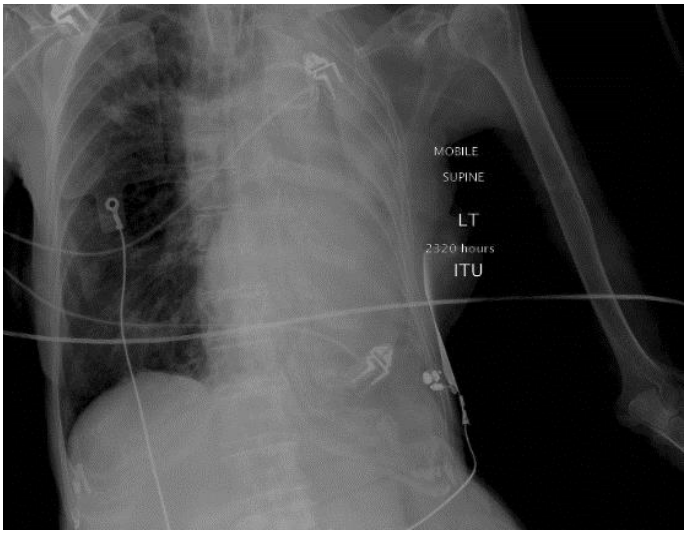

Figure 2. In the ITU; 8 hours after ED admission.

Emergency fibreoptic bronchoscopy was conducted. It showed a clear trachea and right main bronchus. The left main bronchus was completely obstructed with an impacted pale soft tissue mass, with no space to pass the scope beyond it. A flexible biopsy forceps could only be passed as far as the mass, but attempted further insertion could not dislodge it. Biopsies using flexible punch biopsy forceps could only obtain small pieces of gelatinous material. There were no signs of active bleeding following obtaining these samples. Due to the lack of advanced thoracic surgery facilities on site, rigid bronchoscopy was not a treatment option.

External compressions to the left side of the chest synchronised with bagging and suctioning were instituted in order to try to dislodge the impact masses. This was very quickly successful and two specimens (3 and 5 cm length) of organised blood clots (Figure 3) were recovered from the left main bronchus, which restored its patency. This was followed by instant reinflation of the left lung with significant improvement of oxygenation. Serial ABGs (Table 1) and CXRs (Figure 4, Figure 5) showed the significant characteristic rapid changes during the course of treatment.

Figure 3. The two blood clots removed from the trachea through the E.T.T.

Time	**15:23**	16:45	17:05	**18:01**	20:20	22:50	**02:30**	06:45
	On admission	**Before initial treatment**	**After initial treatment**	**On BiPAP support**	**After collapse**	**Controlled ventilation: ITU**	**After clot extraction (1)**	**After clot extraction (2)**
pH	**7.36**	7.04	7.26	**7.2**	7.05	7.01	**7.22**	7.26
pCO2	**7.9**	15.3	7.5	**10.45**	13.05	11.25	**8.05**	7.33
pO2	**5.9**	5.6	5.2	**6.5**	4.6	5.5	**10.32**	10.65
SpO2	**78 %**	85 %	50.%	**88 %**	39 %	85 %	**92 %**	96 %
BE	**6.3**	3.5	3.3	**2.9**	- 11.3	-4.9	**-3.9**	- 3.2
GCS	**11/15**	10/15	10/15	**14/15**	3/15	ETT/sed.	**ETT/sed.**	ETT/sed.

Table 1. Serial changes of the ABGs and the level of consciousness since admission.

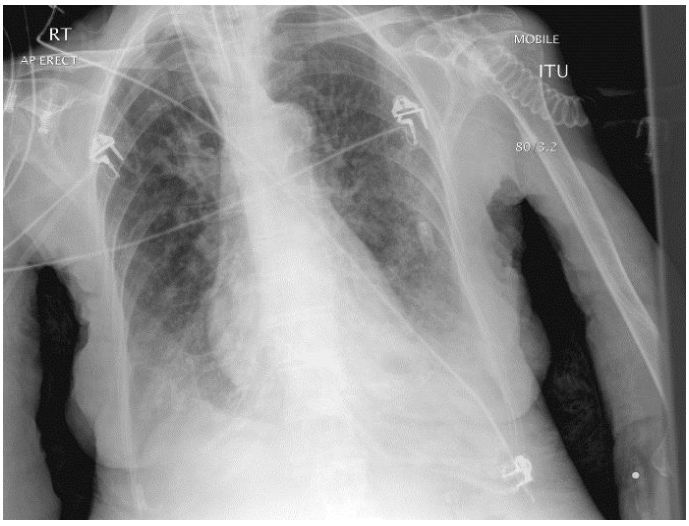

Figure 4. 4 hours after blood clot extraction.

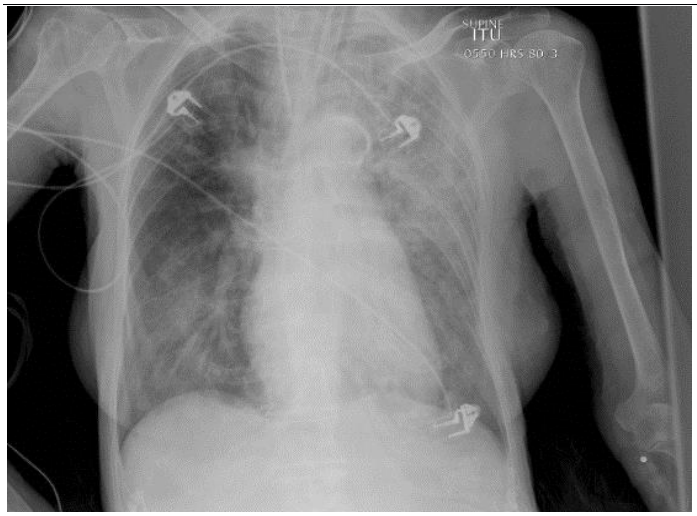

Figure 5. Fifth day in the ITU before transfer to the ward.

Following full recovery and extubation of the trachea, three days later, a CT scan of the chest showed a new growth in the right main bronchus and its tributaries (Figure 6). The patient was transferred to the ward on the fifth day of admission for end of life care where she developed an episode of bradycardia and loss of consciousness a few hours later. She passed away peacefully in the presence of her family.

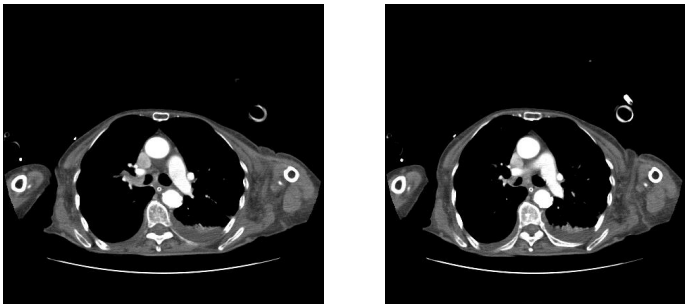

Figure 6. CT scan chest, fourth day in ITU after clot extraction showing intra-luminal space occupying lesion in the right main bronchus and was extending downward.

Discussion

The differential diagnosis of respiratory distress associated with haemoptysis is extensive, and includes: infection, foreign body obstruction (especially in children causing upper airway obstruction), lower airway obstruction, trauma, space occupying lesions (especially lipoma and hamartoma), tracheal stenosis, tuberculosis, cystic fibrosis, pulmonary sarcoidosis and amyloidosis.

To reach the correct diagnosis, the following investigations could be helpful: plain CXR: both postero-anterior and lateral views; CT scan; MRI; bronchoscopy and biopsy either through fibre-optic or rigid endoscopy.

The management of the pulmonary lesions associated haemoptysis should be tailored to the cause if it is known. This could be both medical with antibiotics, chemotherapy, radiotherapy via external exposure to radiation or through brachytherapy and lastly various surgical procedures including bronchoscopic cautery, lobectomy, and pneumonectomy.

Conclusion

This is a description of a rare complication during BiPAP support ventilation whilst treating an episode of acute respiratory failure associated with haemoptysis. It resulted in serious packing of the bronchial tree with organised blood clots that caused complete occlusion of the left main bronchus. A previously unreported method of recruitment of the lung through external chest compression synchronised with bagging and suctioning was recruited and cleared the obstructed airway.

Selective application of BiPAP supportive ventilation treatment in patients with respiratory failure is often very successful. However, BiPAP supportive ventilation and other modes of positive pressure ventilation in the presence of active bleeding might conceal haemoptysis that could precipitate bronchial obstruction with blood or blood clots; this is also applicable for copious secretions. In turn, this might lead to lung collapse and acute respiratory failure due to bronchial occlusion. Continuous assessment and active medical or surgical treatment for haemoptysis should follow the initiation of the positive pressure ventilation.

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