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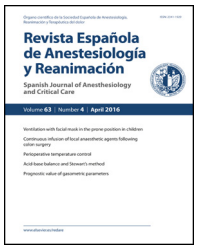

CASE REPORT

Single-lung ventilation with bronchofibroscopy during lung resection surgery☆

B. Cimadevilla Calvo[a,*], C. López Sánchez[a], J.M. Rabanal LLevot[a], L. Sánchez Moreno[b]

[a] *Servicio de Anestesiología, Reanimación y Terapéutica del Dolor, Hospital Universitario Marqués de Valdecilla, Santander, Cantabria, Spain*
[b] *Servicio de Cirugía Torácica, Hospital Universitario Marqués de Valdecilla, Santander, Cantabria, Spain*

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One lung ventilation

Abstract Lung isolation using one-lung ventilation is common during thoracic surgery procedures, as it allows proper visualisation and manipulation of the lung to be operated on. Selective lobar blockade has been described in patients that do not tolerate one-lung ventilation, and is usually achieved using endobronchial blockers. However, it depends on endobronchial blocker availability, its complexity regarding proper positioning, and the need for constant monitoring to ensure the correct placement of the bronchial seal.

In the clinical case to be described, a new method was used to increase the available surface for oxygen exchange. This was accomplished by means of direct supply of oxygen through the bronchoscope's working channel to one of the not-to-be operated-on, non-ventilated lung lobes. With this technique, the surgeon had an optimal operating field, oxygenation from one-lung ventilation improved and no perioperative complications were found.

PALABRAS CLAVE
Oxigenación unilobar;
Oxigenación con fibrobroncoscopio;
Cirugía de resección pulmonar;
Ventilación unipulmonar

Oxigenación unilobar con fibroscopio durante cirugía de resección pulmonar

Resumen El aislamiento pulmonar mediante ventilación unipulmonar es frecuente en procedimientos de cirugía torácica, ya que permite una mejor visualización y manipulación del pulmón a intervenir. El bloqueo lobar selectivo está descrito en pacientes que no toleran la ventilación unipulmonar y se suele realizar por medio del bloqueador bronquial. Sin embargo, su realización está condicionada por la necesidad de disponer de dicho bloqueador, por la complejidad para su correcta colocación y la necesidad de vigilancia intensiva para asegurar la adecuada colocación del sellado bronquial.

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* Corresponding author.
E-mail address: drbcimadevilla@yahoo.es (B. Cimadevilla Calvo).

En el caso que presentamos hemos aplicado una técnica novedosa para aumentar la superficie de intercambio de oxígeno. Se ha logrado mediante la administración directa de este por el canal del fibrobroncoscopio a uno de los lóbulos no ventilados no objeto de la cirugía. Mediante esta técnica, el cirujano se benefició de un campo quirúrgico óptimo, se mejoró la hipoxemia de la ventilación unipulmonar y no se observó ninguna complicación perioperatoria.

Introduction

Lung isolation is needed in thoracic surgery to allow the surgeon to visualise and manipulate the operative lung. While insertion of a double lumen tube (DLT) is the standard technique, the use of bronchial blockers (BB) is becoming more common.

A common problem during one-lung ventilation (OLV) is hypoxaemia, particularly in patients with reduced pulmonary function reserve. Approximately 5–10% of patients who survive lobectomy or pneumonectomy due to lung cancer develop secondary lung cancer within 5 years that often requires reintervention, sometimes involving resection of the contralateral lung. These patients cannot usually tolerate OLV and develop hypoxaemia. Several techniques are available to address this situation.

First, lobe-selective bronchial blockade can be achieved by inserting a BB through a DLT or single lumen tube.[1,2] However, BBs can only be used when a fiberoptic bronchoscope wide enough to accommodate the device is available, and the technique requires extensive training and excellent knowledge of the anatomy of the bronchial tree. BBs are also more expensive than DLTs, take longer to collapse the lung, and sometimes need to be repositioned several times during surgery. For these reasons, they are not available in all hospitals.

A second option is the administration of continuous positive airway pressure through the blocked branch of the DLT. This, however, can obstruct video-assisted thoracoscopy (VATS), and usually requires reconversion to thoracotomy.

The third option is to ventilate the spared lobe of the operated lung in order to increase the surface area available for gas exchange while minimising interference with the surgical field. This allows lung resection to be performed using VATS. To achieve this, we have devised a novel technique that involves administering O_2 in the target lobe via the working channel of a flexible fibreoptic bronchoscope connected to a source of O_2. Gas is delivered at a flow rate of between 2 and 3 L, depending on the target peripheral oxygen saturation (SpO_2).

We describe a clinical case in which this technique was used successfully in a patient with previous lung resection of the left upper lobe. The patient had been programmed for VATS resection of the right middle lobe (RML) due to tumour recurrence, and was unable to tolerate OLV.

Case report

A 66-year-old man with a surgical history of left upper lobectomy plus lymphadenectomy 1 year previously due to squamous cell carcinoma pT1 N2, stage IIIA, had been diagnosed with recurrence in the RML in the latest follow-up. The patient was scheduled to undergo right middle lobectomy with VATS in the thoracic surgery operating room.

His personal history was: no known allergies; ex-smoker of half a pack of cigarettes per day; percutaneous transluminal coronary angioplasty with stent 1 year previously. Background treatment: Adiro 100®, bisoprolol 2.5 mg, atorvastatin 20, omeprazole and paracetamol/tramadol.

Additional studies included a high definition chest CT scan that showed changes secondary to upper left lobectomy; prevascular, bilateral paratracheal, subcarinal and prevascular mediastinal lymph nodes with no changes with respect to the previous study; normal cardiothoracic index, normal calibre aorta and pulmonary artery; stent in right coronary artery; middle lobe lesion showing slightly increased size and spiculation with respect to the previous study; no pleural effusion. Lung function tests showed: FVC 4.8 L (139.1%), FEV1 3.62 L/s (134%), ratio: 75.42%.

Once in the operating room, with baseline SpO_2 of 94%, sinus rhythm at 63 bpm and blood pressure 150.82 mmHg, standard monitoring was performed. Before anaesthesia induction, the patient was preoxygenated for 5 min with FiO_2 of 1, which increase SpO_2 to 99%. After this, anaesthesia was induced with propofol (50 mg + 125 mg), fentanyl (100 mcg), rocuronium (10 mg), and succinylcholine (100 mg). Face mask ventilation (Han grade III) was difficult, but intubation (Cormack–Lehane grade I) with a left 39 Fr DLT was easy. A dual catheter was placed in the right subclavian vein, the left radial artery, and a second 16G-gauge peripheral line was placed in the right arm. In addition, a right paravertebral catheter was placed at the level of T6. Anaesthesia was maintained with boluses of desflurane, remifentanil and rocuronium.

OLV was started with $SatO_2$ at 99% and $EtCO_2$ at 35 mmHg in bipulmonary ventilation (BPV). Five minutes later, $SatO_2$ fell to 84%, forcing us to return to BPV with FiO_2 of 1. Pulmonary recruitment manoeuvres were performed, which brought $SatO_2$ up to 100% with FiO_2 of 0.8. After the third attempt of OLV with FiO_2 of 1, it was clear that the patient would not tolerate OLV. Faced with this situation, we considered several options. On the one hand, a BB in the RML. This