



## The Use of High Flow Nasal Oxygen (Optiflow) for Oxygenation in Patient with Pulmonary Fibrosis During Spinal Anesthesia: A Case Report

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### Abstract

Idiopathic pulmonary fibrosis (IPF) is an interstitial lung disease characterized by chronic, progressive scarring of the lungs and the pathological hallmark of usual interstitial pneumonia. The peri-operative management of patients with IPF is problematic, with the risk of acute respiratory failure pre or post operatively. Through a case study of a 67-year-old female patient, followed for an advanced pulmonary fibrosis, and a review of the literature, we present the anesthetic management of prosthetic hip surgery in patients with pulmonary fibrosis. And the interest of the use of high flow nasal oxygen in anesthesia for patient with IPF. The use of high-flow nasal oxygenation (HFNO) for IPF patients with acute respiratory failure has been reported, and has been shown to reduce the length of stay in the ICU compared with mechanical ventilation, with no difference in mortality. But its use for the anesthesia of these patients is very little described.

**Keywords:** Pulmonary Fibrosis; HFNO; Spinal Anesthesia; Total Hip Replacement

### Introduction

Idiopathic pulmonary fibrosis (IPF) is an interstitial lung disease characterized by chronic, progressive scarring of the lungs and the pathological hallmark of usual interstitial pneumonia. Current paradigms suggest alveolar epithelial cell damage is a key initiating factor. Studies have reported an increase in the incidence of IPF, with associated high morbidity, mortality, and economic healthcare burden. Diagnosis relies on a multidisciplinary team approach with exclusion of other causes of interstitial lung disease [1].

The peri-operative management of patients with IPF is problematic, with the risk of acute respiratory failure pre or post operatively.

Total hip arthroplasty (THA) surgery is a functional surgery that involves the replacement of a damaged joint to improve the

patient's quality of life. It can be performed under general or local anesthesia. Three major complications can be observed in the surgery: perioperative bleeding, bone cement implantation syndrome and thromboembolism [2]. This risk is increased in patients with chronic respiratory disease, including idiopathic pulmonary fibrosis.

Through a case study and a review of the literature, we present the anesthetic management of prosthetic hip surgery in patients with pulmonary fibrosis.

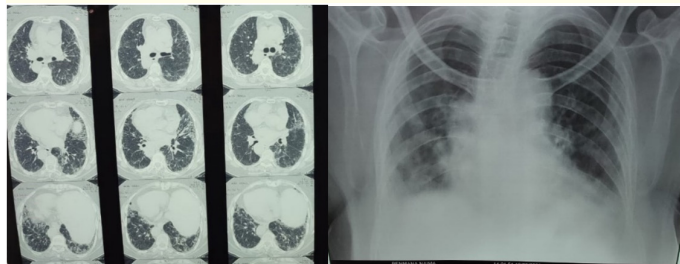
### Case Report

We report the case of a 67-year-old female patient, with history of Hypertension under ACE inhibitor, followed for an advanced pulmonary fibrosis for more than five years on long-term corticosteroid therapy 10mg/day with home oxygen therapy (3 Litres/min). Allergic to penicillin. Admitted for management of coxarthrosis of the left hip, with indication for total hip replacement.

The patient’s weight was 83kg, her height was 162 cm, BMI 31,6 kg/m<sup>2</sup>, her functional capacity was < 4 METs, she has no angina, no signs of heart failure. Cardiac auscultation was normal. HR was 70 beats/minute. Blood pressure was 157/109 mmHg.

Respiratory, she had NYHA stage IV dyspnea, her pulse oxygen saturation on room air was 86%, and her respiratory rate was 22 bpm. Arterial blood gases to room air: PaO<sub>2</sub>: 60 mm Hg, PacO<sub>2</sub>: 38.6 mm Hg, pH: 7.44, SpO<sub>2</sub>: 87%, HCO<sub>3</sub><sup>-</sup>: 26.2. The SARS-CoV-2 Rt-PCR was negative.

The radiology of the front lung and the thoracic CT scan were in favor of an advanced pulmonary fibrosis. The functional respiratory examinations showed a moderate restrictive ventilatory disorder with a total lung capacity of 46%, without associated obstructive ventilatory disorder.



**Figure 1:** Chest CT scan and Frontal lung X-ray of our patient.

Transthoracic echography showed a normal left and right ventricle, LVP normal, LVEF at 69%, left atrium dilatation (surface: 23 cm<sup>2</sup>, anteroposterior diameter: 40 mm), no valvopathy, with moderate pulmonary hypertension.

The patient was classified ASA IV, scheduled for surgery at intermediate cardiovascular risk, and at high bleeding risk (Total hip replacement).

After multidisciplinary discussion and evaluation of the benefits/risks of each anesthetic technique, and after the patient’s consent, we opted for loco-regional anesthesia and placement of cementless total hip prosthesis.

After a pre-operative respiratory assessment, and a 6-hour pre-operative fasting. The patient was admitted to the operating room.

Pulse oxygen saturation, ECG and non-invasive blood pressure monitoring.

Two 16G peripheral venous lines were taken, and a right radial arterial line (for blood gas). Prefilling with 250 ml of isotonic saline.



**Figure 2:** Per operative image of our patient.

Combined peri-spinal anesthesia was performed, by introduction of a 16G Tuohy needle into the L2-L3 epidural space, introduction of a 26G spinal needle (needle through needle technique). After obtaining cerebrospinal fluid (CSF) return, injection of 12.5 mg hyperbaric bupivacaine, 50 µg fentanyl, 100 µg morphine. after removal of the spinal needle, placement of a catheter in the epidural space. intraoperative ventilation was performed by high-flow oxygen therapy, with a flow rate at 30l/min and FiO<sub>2</sub>: 50%. There was no respiratory or hemodynamic compromise.

Intraoperative arterial blood gas showed: PaO<sub>2</sub>: 140 mmHg, PacO<sub>2</sub> mmHg: 36.7, pH: 7.43, SpO<sub>2</sub>: 100%.

The procedure lasted 2h30, there were no intra operative incidents (No hypotension, moderate bleeding <400ml, the patient remained respiratory stable), with no need for reinjections of local anesthetic.

The patient was put back on Oxygen at the usual flow rate (3l/min goggles). after 3 and a half hours of the anesthesia. The post-operative blood gas found: PaO<sub>2</sub>: 70 mmHg, PacO<sub>2</sub> mmHg: 38.8, pH: 7.45, SpO<sub>2</sub>: 95%.

The patient was transferred to the orthopedic surgery department after 2 hours in the postoperative surveillance room.

Postoperative analgesia by epidural catheter (Normo-baric bupivacaine at the dilution of 0.125% in electric syringe pump).

Prevention of thrombo-embolic disease introduced after 12 hours postoperatively, after verification of the absence of bleeding, by LMWH 40 mg subcutaneously. Functional rehabilitation protocol started the day after the operation. The postoperative course was simple and the patient was discharged on day 5.

**Discussion**

Total hip arthroplasty (THA) surgery is a functional surgery that involves the replacement of a damaged joint to improve the patient’s quality of life. It can be performed under general or regional anesthesia.

The following table shows the main criteria for choosing the type of anesthesia [2].

General anesthesia	Regional anesthesia
Controlled respiration	Early mobilization
Hemodynamic control	Better post-operative pain control
Immobilization of the patient	
Patient comfort	
Higher Thromboembolic risk.	

**Table 1**

Anesthesia for patients with idiopathic pulmonary fibrosis is associated with an increased operative risk, with an increased risk of morbidity and mortality, particularly in the case of surgical procedures involving postoperative impairment of respiratory function. Preoperative respiratory assessment is an important part of the management of these patients [3].

The choice of the best anesthetic technique for these patients is still debated. Although intuitively regional anesthesia is preferred whenever possible, there is little evidence to support this. When general anesthesia is used, the aim is to extubate the patient early, even after major surgery.

Spinal anesthesia can be responsible of little respiratory depression by the extension of the motor block to the inspiratory muscles or due to the use of intrathecal morphine. This would have been fatal for our patient if the intraoperative respiratory manage-

ment was inadequate, hence the need for an effective intraoperative oxygenation method that would limit this impact. We thought of using the high-flow nasal oxygenation (HFNO) as a method of intraoperative oxygenation.

The use of high-flow nasal oxygenation (HFNO) for IPF patients with acute respiratory failure has been reported, and has been shown to reduce the length of stay in the ICU compared with mechanical ventilation, with no difference in mortality. but its use for the anesthesia of these patients is very little described

High flow nasal oxygenation (HFNO) can overcome the shortcomings of conventional oxygen delivery devices. It can deliver a wide range of FiO2 from 21% to 100% and flexible flow up to 70 L/m.

The advantage of the HFNO is that it can insufflate oxygen, even when a patient become apneic, preventing or delaying the onset of hypoxia and giving the anesthesia provider extra minutes to manage the airway. The washout effect of high oxygen flow on the upper airway dead space will certainly improve ventilation, as well as serve as a great vehicle to move carbon dioxide, ameliorating the hypercarboxia that may be associated with apneic oxygenation. Many studies have demonstrated that HFNO can generate positive nasopharyngeal airway pressure at the end of exhalation (PEEP), which can potentially decrease the work of breathing and improve alveolar ventilation [4], in addition to its easy set up and high tolerability.

The use of HFNO during the induction of anesthesia, for apneic oxygenation and during upper airway surgeries has been initiated. but its use as a means of intraoperative oxygenation in patients with chronic respiratory insufficiency is very little described in the literature.

For all these advantages mentioned above, we chose to oxygenate our patient intraoperatively with HFNO. We had no respiratory events during the operation, the patient was put back on oxygen very quickly at the usual flow rate, and we did not have any problem of ventilatory weaning.

Therefore, optiflow seems to be a very good means of intraoperative oxygenation in patients with advanced pulmonary fibrosis during loco-regional anesthesia.

## Conclusion

HFNO is a promising new technique that keeps patients safer during anesthesia. Especially for patients with chronic respiratory insufficiency, Despite the mounting evidence supporting its use, more research and clinical trials are needed in order to establish the ideal use of this technique in various population.

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