



CASE REPORT

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High-Flow Nasal Cannula Oxygen Therapy during Deep Intravenous Sedation for Cataract Surgery in the Elderly: A Case Report

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ABSTRACT

In a multidisciplinary approach between the anesthesiologist and the ophthalmologist, we report the successful use of High-Flow Nasal Canula (HFNC) oxygen therapy in a sedated, obese, anxious, old patient undergoing cataract surgery under deep Intravenous (IV) sedation to eliminate his upper airway obstruction, heavy snoring, apnea, and oxygen desaturation while using a regular nasal cannula for oxygen supply, thus avoiding the need for general anesthesia with endotracheal intubation or case cancellation.

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Cataract surgery; High-Flow Nasal Cannula (HFNC) oxygen therapy; Intravenous (IV) deep sedation; Complication; Obstructive Sleep Apnea (OSA)

Abbreviations

HFNC-High-Flow Nasal Canula; IV-Intravenous; OSA-Obstructive Sleep Apnea; SpO₂-Pulse Oximetric Oxygen Saturation; ASA-American Society of Anesthesiologists; BPM-Beats Per Minute; FiO₂- Fraction of Inspired of Oxygen; CPAP/PEEP-Continuous Positive Airway Pressure/Positive End Expiratory Pressure; FRC-Functional Residual Capacity

Introduction

In a multidisciplinary approach between the anesthesiologist and the ophthalmologist, we report the successful use of High-Flow Nasal Canula (HFNC) oxygen therapy in a sedated, obese, anxious, old patient undergoing cataract surgery for insertion of intraocular lens prosthesis in his left eye under deep intravenous (IV) sedation. Due to his past medical history of anxiety disorder, he had to receive IV sedation with midazolam, dexmedetomidine, and propofol instead of relying only on retrobulbar block for his surgery. Shortly after, the patient developed several episodes of heavy snoring and apnea with resultant oxygen desaturation reaching a pulse oximetric oxygen saturation (SpO₂) value of 91% while on regular nasal cannula for oxygen supply. HFNC oxygen therapy was opted to eliminate his heavy snoring and apne-

ic episodes while maintaining a normal SpO₂ value of 100%. After that, the patient was comfortably sedated and hemodynamically stable throughout the surgical procedure while avoiding involuntary movements, surgical interruptions, advanced airway instrumentation, general anesthesia and endotracheal intubation, or case cancellation. The ophthalmologist was very satisfied as this multidisciplinary approach allowed a smooth surgical operation. HFNC oxygen therapy can be beneficial in preventing hypoxemia and maintaining adequate surgical conditions for cataract surgeries under deep IV sedation in this patient population.

Case Presentation

A 60-year-old obese male with a past medical history of anxiety disorder receiving daily oral escitalopram presented for an elective cataract phacoemulsification for an intraocular lens prosthesis insertion in his left eye for a 3+ nuclear sclerosis previously diagnosed in the ophthalmology clinics. His past ocular history was otherwise negative. He weighed 101 kg and had a BMI of 34.9 kg/m². His past medical history was negative for cardiovascular and pulmonary diseases. The patient denied smoking, alcohol use, or being previously diagnosed with Obstructive Sleep Apnea (OSA). However, after his cataract surgery was

completed, his wife reported observed night time loud snoring and repetitive awakenings accompanied by gasping, which may be suggestive of a missed diagnosis of OSA.

Upon presenting to the operating room, the patient was started on 3 L/min of oxygen via a regular nasal cannula and mild anxiolysis was induced by the administration of 1 mg of IV midazolam. Pulse oximetric oxygen saturation (SpO_2) probe, end-tidal capnography, non-invasive blood pressure measurements, and electrocardiography were recorded as per the American Society of Anesthesiologists (ASA) standards. After that, an IV infusion of 0.5 mcg/kg/h of dexmedetomidine was started. His blood pressure measurement was 126/75 mm Hg with a heart rate of 60 beats per minute (bpm) and a SpO_2 value of 100%. Before the retrobulbar block, the patient had to receive a small IV bolus of 20 mg of propofol so that the block can be smoothly performed by the ophthalmologist using 5 mL of 1% lidocaine. Shortly after the IV bolus of propofol, the patient developed significant upper airway obstruction with heavy snoring and apnea that necessitated chin lift and jaw thrust to reverse the oxygen desaturation (down to 91%); regular nasal cannula oxygen flow also was increased to 6 L/min and the IV infusion of dexmedetomidine was stopped. Upon initial release of the chin lift-jaw thrust manoeuvre, moderate snoring and hypopnea re-occurred yet SpO_2 values were maintained above 95%. However, five minutes later, frequent episodes of heavy snoring and apnea with oxygen desaturation (down to 88%) developed that necessitated again a chin lift-jaw thrust manoeuvre, which led to involuntary movements, agitation, and resultant surgical interruption. Unable to continue the cataract surgery, the anaesthesiologist and the ophthalmologist decided to start the patient on HFNC oxygen therapy at a fraction of inspired oxygen (FiO_2) of 40% and a flow of 30 L/min. With the initiation of HFNC oxygen therapy, SpO_2 values immediately increased towards 100%; however, mild snoring persisted. When the flow of the HFNC oxygen therapy was increased from 30 L/min to 50 L/min, snoring resolved completely and SpO_2 values were maintained at 100% allowing the ophthalmologist to continue the cataract surgery. During the surgery, an attempt was made to reduce the flow of the HFNC oxygen therapy from 50 L/min to 30 L/min which resulted in the re-occurrence of mild snoring but without significant oxygen desaturation. The surgical team raised a concern regarding the return of snoring, and as such the flow was increased back to 50 L/min so that snoring gets completely eliminated. The surgery was smoothly completed after that. The patient tolerated the procedure very well with comfortable sedation

and hemodynamic stability. The application of HFNC oxygen therapy allowed for successful smooth cataract extraction and intraocular lens insertion without further involuntary movements, agitation, surgical interruption, snoring, apnea, or oxygen desaturations.

Discussion

New sedation techniques have been increasingly in demand to allow patients at risk of upper airway obstruction to undergo cataract surgery. Moderate to deep IV sedation results in partial or complete loss of the tone of the upper airway skeletal muscles, potentially leading to apnea and oxygen desaturation [1].

In our anxious patient, a small IV bolus of propofol was given to deepen the level of sedation before receiving the somewhat painful retrobulbar block. A retrobulbar block is associated with higher levels of patient satisfaction during and after cataract surgery since it minimizes pain perception significantly [2]. After that small IV bolus of propofol, our patient exhibited signs and symptoms of significant upper airway obstruction. Rather than inserting an oropharyngeal or nasopharyngeal airway device to relieve the obstruction and maintain adequate oxygenation, we elected to use HFNC oxygen therapy. The intra-procedural use of oropharyngeal or nasopharyngeal airway devices requires a well maintained deep level of IV sedation while a HFNC is simple, non-invasive, easy to use, and well tolerated by all patients [3]. Also, the insertion of oropharyngeal or nasopharyngeal airway devices is known to frequently injure the fragile nasal or oral mucosa resulting in mucosal bleeding, and sometimes induce coughing and laryngeal spasms, while a HFNC is a much safer alternative to maintain the upper airway skeletal muscle tone preventing apneas and subsequent hypoxemia.

Reversal of snoring, apnea, and oxygen desaturation with a HFNC could be attributed to two different mechanisms. First, in contrast to a regular nasal cannula and other simple oxygen delivery devices, a HFNC delivers optimally heated and humidified gas mixtures at high flows in the range of 30-60 L/min while maintaining a constant FiO_2 that is usually not affected by the patient's peak flow requirements, breathing pattern, and minute ventilation [3]. Second, the resulting CPAP/PEEP (continuous positive airway pressure/positive end expiratory pressure) levels at flows in the range of 30-60 L/min during HFNC oxygen therapy can stent the upper airway, reverse partial or total upper airway obstruction, and increase the functional residual capacity (FRC) of the patients [4-7].

Conclusion

Several studies have reported the benefits of HFNC oxygen therapy in patients receiving IV sedation while undergoing different types of surgeries.

However, to our knowledge our case report may be the first to describe the successful use of HFNC oxygen therapy in eliminating snoring and apneic events while maintaining normal SpO₂ values in cataract surgeries of the elderly obese population. We suggest that HFNC oxygen therapy can be beneficial in these surgeries while receiving deep IV sedation. This patient population might be denied their cataract surgery or might have to undergo general anesthesia with endotracheal intubation to be able to have a better life quality regarding their vision. The use of HFNC oxygen therapy can be extrapolated to patients who cannot lie flat due to intolerable shortness of breath from cardiovascular and pulmonary diseases. Expanding the application of HFNC oxygen therapy is promising and it gives hope to elderly patients who might be turned down for their cataract surgery.

Declarations

Ethics approval and consent to participate

The American University of Beirut Medical Center (AUBMC) Institutional Review Board (IRB) does not require its approval for the involvement of human participants in the publication of case reports.

Consent for publication

Written informed consent was obtained from the patient for the publication of this case report.

Availability of data and materials

Not applicable

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

NAN contributed as a first author in discussing and in-

terpreting the case, drafting, and approving the final version of the manuscript. AH, CK, and RM contributed to interpreting the case, drafting, and approving the final version of the manuscript. AK contributed to discussing and interpreting the case, drafting, and approving the final version of the manuscript. All authors read and approved the final manuscript.

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