The use of nasal high flow oxygen to aid the management of respiratory failure and obesity in a district general maternity unit

Published: 22 Oct 2015

© Anaesthesia Cases / 2015-0170

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Summary
Nasal high flow (NHF\textsuperscript{TM}) oxygen using the Optiflow\textsuperscript{TM} system (Fisher & Paykel Healthcare Limited, Panmure, Auckland, New Zealand) is frequently used in our hospital in the management of type one respiratory failure. We present two cases where we have used NHF\textsuperscript{TM} in our maternity unit. In the first case, this was used in the management of respiratory failure and as an adjunct at induction of general anaesthesia, and in the second, to facilitate safe neuraxial anaesthesia in a morbidly obese patient. Our experience of this equipment has prompted our department to consider its use beyond managing respiratory failure in critical care but also an adjunct for use in the operating theatres and maternity unit.

Introduction
Nasal high flow (NHF\textsuperscript{TM}) oxygen can provide 100% oxygen at flow rates of up to 70 l.min\textsuperscript{-1}. We propose that due to the high oxygen concentrations and continuous positive airways pressure (CPAP), including positive end expiratory pressure (PEEP), that NHF\textsuperscript{TM} can be used not only to manage respiratory failure, but also improve oxygenation at induction of anaesthesia [1]. We believe NHF\textsuperscript{TM} also has a place in preventing hypoxia and atelectasis in patients undergoing neuraxial blockade, especially in high risk groups such as the obese or in late pregnancy.

Report
Case 1
A 39-yr-old nulliparous female with a history of smoking and previous intravenous drug use presented at 35 weeks gestation complaining of a three-day history of cough, myalgia and dyspnoea. At presentation, the patient's oxygen saturation (SpO\textsubscript{2}) was 93% breathing room air and her respiratory rate was 18 breaths.min\textsuperscript{-1}. Her pulse was 90 beats.min\textsuperscript{-1} sinus rhythm, blood pressure was normal and she was afebrile. Clinical examination revealed right sided basal crepitations. A chest radiograph showed poor lung expansion during inspiration, but was otherwise unremarkable. Blood tests showed raised neutrophils (15.3 x 10\textsuperscript{9}.l\textsuperscript{-1}) and a raised CRP (90 mg.l\textsuperscript{-1}). A fetal cardiotocograph was reassuring. She was treated with co-amoxiclav, oseltamivir and intravenous fluids. Over the next few hours her oxygen requirements increased, with saturations of 93% breathing 15 l.min\textsuperscript{-1} via a trauma mask. NHF\textsuperscript{TM} (FiO\textsubscript{2} 1.0 at 70 l.min\textsuperscript{-1}) was commenced relieving the patient's dyspnoea and improving her SpO\textsubscript{2} to 100%. The decision was made to perform an emergency caesarean section due to deteriorating respiratory failure. The NHF\textsuperscript{TM} system was used in addition to a face mask for pre-oxygenation for 3 minutes. Rapid sequence induction was performed using alfentanil 1 mg, sodium thiopental 450 mg and suxamethonium 100 mg. Tracheal intubation was successful using a videolaryngoscope and gum elastic bougie. The time taken from induction to confirmation of tracheal tube position was approximately 90 seconds. The NHF\textsuperscript{TM} system remained in place throughout induction with SpO\textsubscript{2} remaining above 97%. Anaesthesia was maintained using sevoflurane and nitrous oxide in oxygen. Surgery was uneventful. Tracheal extubation occurred at eight hours post-operatively in the intensive care unit. Viral polymerase chain reaction (PCR) was positive for rhinovirus. Mother and child were discharged from hospital 10 days after...
Case 2

A 28-yr-old multiparous female with gestational diabetes and pregnancy-induced hypertension presented at 38 weeks gestation for elective caesarean section and tubal ligation. She weighed 187 kg (BMI 75.2 kg.m$^{-2}$). We chose to perform a combined spinal-epidural (CSE) as a prolonged procedure was likely. Pre-operative preparation included the siting of two large bore intravenous cannulae and invasive arterial blood pressure monitoring. Following successful insertion of the CSE, the patient lay supine on an Oxford head elevating laryngoscopy pillow (HELP$^\text{TM}$) (Alma Medical Foam Converters, Kirtlington, Oxford, United Kingdom) with a left lateral tilt. Sensory block (using a cold spray) reached the level of T3 on the left and T4 on the right. Given the patient’s body habitus, positioning and neuraxial blockade, we were concerned that dyspnoea, atelectasis and hypoxaemia could become problematic. Hence, we started NHF$^\text{TM}$ to provide supplementary oxygen and CPAP/PEEP as soon as the CSE had been sited. Surgery was carried out successfully.

The patient’s SpO$_2$ was maintained at 99-100% on NHF$^\text{TM}$ titrated to 40-60 l.min$^{-1}$ with an FiO$_2$ of 0.5-0.9 with no complaints of dyspnoea or distress. Immediately postoperatively, the patient was transferred to her bed and sat upright. Following withdrawal of the NHF$^\text{TM}$, oxygen saturations decreased to 91% when the patient was breathing room air. We therefore elected to continue the use of NHF$^\text{TM}$ in the recovery phase until the return of motor function of the lower limbs. Her SpO$_2$ was thereafter maintained at 95% breathing room air.

Discussion

We opted to utilise NHF$^\text{TM}$ in both the cases described for a number of reasons. Firstly, the use of the NHF$^\text{TM}$ system was beneficial in the management of respiratory failure in case 1 in both improving the patient’s SpO$_2$ as well as relieving the distress of dyspnoea.

Secondly, the use of the NHF$^\text{TM}$ system has recently been shown to deliver apnoeic oxygenation in patients with known or predicted difficult airways undergoing hypopharyngeal or laryngotraceal surgery [1].

Our experience with Case 1 showed that this method of oxygen delivery helped to alleviate distress for the patient during pre-oxygenation in the supine position. We also found that her oxygen saturation did not fall during the time taken to complete tracheal intubation, despite the patients gestation and underlying respiratory pathology making rapid desaturation likely.

In Case 2, there was no respiratory compromise in a severely obese, heavily pregnant female undergoing neuraxial blockade when using the NHF$^\text{TM}$ system. Within our department we have seen other patients complain of significant breathlessness and distress in similar situations. We believe this technique may help prevent such symptoms, prevent potentially harmful hypoxaemia and reduce the number of patients that may otherwise require emergency general anaesthesia in such circumstances.

These and similar techniques have been described for use in patients with primary airway pathology [1,2] and have also been shown to prolong apnoic time in obese patients [3]. We propose that NHF$^\text{TM}$ should also be considered in patients with respiratory pathology or those at particular risk of hypoxaemia undergoing general anaesthesia or neuraxial block. We suggest that the high flow rates and PEEP delivered with this system will not only provide apnoeic oxygenation at induction of general anaesthesia, but may also alleviate the symptoms associated with intercostal blockade and atelectasis resulting from neuraxial anaesthesia, which are likely to be further compounded by other factors such as obesity and opioid use.

Our experience of the NHF$^\text{TM}$ system in our maternity unit has been positive. Obstetric patients are frequently obese, at significant risk of aspiration, airway compromise and hypoxaemia due to the physiological changes in pregnancy. We believe that NHF$^\text{TM}$ is a useful adjunct to consider in a variety of patients beyond providing apnoeic oxygenation and managing respiratory failure.

Acknowledgements

Published with the written consent of both patients.

Competing Interests

No external funding and no competing interests declared.

References


