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Project: Nasal pressure profile during treatment with high flow humidified therapy

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Introduction:
Patients needing oxygen during their hospital admission are normally offered therapy via nasal cannula at a standard prescription rate of 2 L.min-1. Side effects of this treatment include drying of the nasal mucosa, discomfort and nose bleeding.

Over the last few years high-flow, heated, humidified air (with or without supplemental oxygen) has been introduced – the AIRVO 2 produced by Fisher and Paykel Healthcare is an example of a device that can generate this type of therapy. Patients have reported greatly improved comfort with this newer method and previous research in our unit has shown that they deliver stable oxygen concentrations.

Recent studies have suggested that therapy with high flow, heated, humidified oxygen can reduce the need for re-intubation following surgery. The mechanism for this beneficial effect is not clear. It has been suggested that the delivery of the humidified and warmed air better matches the natural environment and correlates more close with the normal physiological conditions. Other theories suggest a possible washout effect of carbon dioxide or the delivery of positive airway pressure (CPAP) via the high flow rates of 20 – 60 L.min-1.

This study investigates the effect increasing flow rate on intra-nasal pressure. It is expected that higher flow rates would generate higher intranasal pressures. The presence of this positive airway pressure would likely hold clinical importance. CPAP therapy works by increasing the stability of the airway, improving oxygenation and reducing work of breathing. However, the traditional CPAP mask is difficult to tolerate, particularly compared to the nasal cannulae of the AIRVO 2.

Aim:
To assess the effect nasal air flow rates via the AIRVO 2 (High-flow, Heated and Humidified air) on nasopharyngeal pressures under different conditions.

Method:
A total of 25 healthy volunteers without prior nasal surgery nor recent upper airway infection participated in this study. Respiratory effort bands were fastened around the chest and abdomen, with calibration occurring with breathing volumes. These bands were used to monitor ventilation. An intranasal catheter was introduced approximately 5cm into the nasal cavity, the calibration for this was using water pressure.

Recordings were first taken without the AIRVO nasal cannula. Nasal pressure readings were then taken with the AIRVO nasal cannula at flow rates of 20 L.min-1, 40 L.min-1 and 60 L.min-1 with the mouth closed.

Results:
The initial analysis suggests a general trend across each of the 25 participants for an increase in the intra-nasal pressure with each incremental increase in flow rate.

Negative pressures were observed only for the peak inspiratory flows for the 0 L min-1 and 20 L min-1 in a number of participants, otherwise the pressures were all recorded as positive values. There was inter-individual variation in the magnitude of positive pressures – this variation will be analysed with the other data in due course.

Conclusion:
This study has shown that positive airway pressure is generated with high flow humidified air by the AIRVO 2; the higher the flow rate the greater the intra-nasal pressure. While the analysis is preliminary at this stage, it is likely to hold clinical relevance due to the beneficial effects of positive airway pressures, such as increased airway stability.

Increased airway stability is particularly relevant in patients with sleep apnoea (a breathing disorder) and may also be relevant for patients with COPD (Chronic Obstructive Pulmonary Disease). The current methods to deliver CPAP (Continuous Positive Airway Pressure) is via a tight fitting nasal interface, which is, at times, difficult to tolerate.

This study has shown that the AIRVO 2 can also generate increased airway pressure via the increased flow rate and has the benefit of the comfortable nasal cannula.

Further clinical research will need to explore the clinical effects as an alternative for treatment of sleep apnoea and the role in treating or preventing acute exacerbations of COPD.

High-flow, heated, humidified therapy provides a positive air pressure effect in the upper airway. This may be one of the mechanisms of increased efficacy of this type of therapy when compared to traditional low flow oxygen therapy.