What is the evidence for the use of high flow nasal cannula oxygen in adult patients admitted to critical care units? A systematic review

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CRD summary
The review concluded that humidified high flow nasal cannula may be useful as an intermediate therapy to improve oxygenation in adult critical-care patients. The review had some methodological problems and there were quality concerns with the data, which limit the reliability of the authors’ conclusions.

Authors’ objectives
To evaluate the evidence on the clinical effectiveness of humidified high flow nasal cannula (HHFNC) oxygen therapy in adult patients in critical care.

Searching
PubMed, CINAHL, EMB reviews, DARE, EMBASE, Cochrane Database of Systematic Reviews, Academic Search Premier and Joanna Briggs Institute Library of Systematic Reviews were searched to June 2009 for English-language articles. Search terms were reported. Key journals were handsearched. Experts in the field and industry representatives were contacted. Reference lists of relevant reviews and studies were searched. Unpublished studies and conference proceedings were sought using Google and Google Scholar.

Study selection
Studies of HHFNC versus standard oxygen therapy in adult patients (>16 years) already admitted to a critical care unit and who required oxygen therapy were eligible for inclusion. The HHFNC system could be Optiflow, Aquinox, Vapotherm or PARI hydrate, all at a flow greater than 15L/min.

The primary outcome was oxygenation, as measured by partial pressure of arterial oxygenation (PaO$_2$), oxygenation index (PaO$_2$/FiO$_2$) obtained via arterial blood gas (ABG) analysis and pulse oxymetry (SpO$_2$). Secondary outcomes included, costs, mortality, non-invasive ventilation (NIV), positive airway pressure (cmH$_2$O), reduction in work of breathing/improvements in ventilation (PaCO$_2$), intubation rates and patient comfort and tolerance.

The included studies compared either Vapotherm or Optiflow HHFNC devices with traditional oxygen therapy in patients with burns, respiratory failure/insufficiency and post-extubation. Most patients were male (66%).

Two reviewers independently undertook study selection.

Assessment of study quality
Two reviewers independently assessed study validity using Joanna Briggs criteria and Cochrane Collaboration criteria. The quality items assessed included selection bias, performance bias, randomisation, detection bias and attrition bias.

Data extraction
Data was extracted on oxygenation, ventilation, work of breathing, positive airway pressure, patients comfort and compliance, and reduction in complications.

The authors did not report how many reviewers extracted data.

Methods of synthesis
A narrative synthesis was presented grouped by type of outcome.

Results of the review
Eight studies were included in the review (n=259 patients), all of which were abstracts or posters. Study sample sizes
ranged from 10 to 56 patients. Study type was predominantly crossover design, some of which were pilot studies. The authors stated that all studies were published as abstracts or posters and were thus generally of poor quality.

There was a short-term clinical benefit in terms of oxygenation with HHFNC compared with standard oxygen therapy. There were mixed results for work of breathing, which showed a trend towards a reduction in respiratory rate with HHFNC. There was no evidence that HHFNC improved ventilation.

The limited evidence of patient comfort and compliance indicated that HHFNC was generally well tolerated. There were generally fewer complications in the HHFNC group compared with the standard oxygen therapy group.

**Authors’ conclusions**
Humidified high flow nasal cannula may be useful as an intermediate therapy to improve oxygenation in adult critical care patients.

**CRD commentary**
Inclusion criteria for the review were clearly defined. Several relevant databases were searched. There was potential for language bias as only English-language studies were included. Publication bias was not assessed and could not be ruled out. Attempts were made to reduce reviewer error and bias during study selection and quality assessment; it was unclear whether the same applied for data extraction. The included study designs were predominantly crossover design and so liable to various biases, notably carry-over and order of treatment biases. Quality assessment indicated that the studies were generally of poor quality/poorly reported; this was not surprising as all of the studies were available in poster or abstract-only format. Studies were narratively synthesised, which appeared appropriate for the type of data.

The review had some methodological problems and there were quality concerns with the data, which limit the reliability of the authors’ conclusions.

**Implications of the review for practice and research**

**Practice:** The authors stated that since oxygen therapy is a nurse-driven intervention there is a need for nurses to take leadership and responsibility to ensure new therapy is researched.

**Research:** The authors stated that further research should focus on the assessment of HHFNC over the duration of the therapy, effects of HHFNC in patients with type II respiratory failure, assessment of long-term outcomes (including reduction in NIV rates, mortality and length of stay) and use of HHFNC as a weaning tool to prevent reintubation. There was also a need for development and evaluation of a standardised assessment tool for assessing dyspnoea and comfort in the intensive care population.

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