Title: Non-Invasive Continuous Positive Airway Pressure (CPAP) for the Management of Acute Respiratory Distress in Pre-Hospital and Rural Community Settings: Clinical and Cost Effectiveness and Guidelines for Use

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Research question:

1. What is the clinical effectiveness of non-invasive continuous positive airway pressure versus endotracheal intubation for the management of acute respiratory distress in adults with congestive heart failure, pulmonary edema, COPD, asthma and pneumonia in pre-hospital and rural community settings?

2. What is the cost effectiveness of non-invasive continuous positive airway pressure versus endotracheal intubation for the management of acute respiratory distress in adults with congestive heart failure, pulmonary edema, COPD, asthma and pneumonia in pre-hospital and rural community settings?

3. What are the guidelines for use of non-invasive continuous positive airway pressure for the management of acute respiratory distress in adults in pre-hospital and rural community settings?

Methods:

A limited literature search was conducted on key health technology assessment resources, including PubMed, the Cochrane Library (Issue 1, 2008), University of York Centre for Reviews and Dissemination (CRD) databases, ECRI, EuroScan, international HTA agencies, and a focused Internet search. Results include articles published between 2003 and March 2008 and are limited to English language publications only. Search filters were applied to limit the retrieval to health technology assessment, systematic reviews, guidelines, economic evaluations, randomized controlled trials, non-randomized controlled trials and observational studies. Internet links are provided, where available.

The summary of findings was prepared from the abstracts of the relevant information.

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Results:

HTIS reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews and meta-analyses are presented first. These are followed by randomized controlled trials, observational studies and evidence-based guidelines.

No health technology assessments, economic analyses, or randomized controlled trials were identified that specifically examined the use of non-invasive continuous positive airway pressure (CPAP) for the management of acute respiratory distress in pre-hospital and rural community settings. Three systematic reviews and meta-analyses, and one observational study examining use in hospital settings were identified and summarized below. Further information for the use of noninvasive ventilation in hospital settings is located in the appendix.

Overall summary of findings:

Ferreyra et al., performed a systematic review to examine the clinical effectiveness of using CPAP versus standard medical therapy for the prevention of post-operative pulmonary complications, atelectasis, pneumonia and intubation in patients undergoing major abdominal surgery. The meta-analysis pooled data from nine RCTs to estimate the pooled risk ratio and the number needed to treat to benefit (NNTB) for PPCs, atelectasis and pneumonia. Results indicated that CPAP significantly reduced the risk of post-operative pulmonary complications, atelectasis and pneumonia. The authors concluded that CPAP diminishes the risk of postoperative pulmonary complications, atelectasis, and pneumonia in patients undergoing abdominal surgery.

Winck et al., conducted a systematic review to compare two non-invasive ventilation techniques for the treatment of acute cardiogenic pulmonary edema. RCTs were identified that compared CPAP and/or non-invasive positive pressure ventilation (NPPV) with standard medical therapies. The main outcomes of interest were a reduction in the need for endotracheal intubation and mortality. The meta-analysis pooled results from 10 RCTs comparing CPAP to standard medical therapy. Results showed a 22% absolute risk reduction (ARR) in the need for endotracheal intubation and a 13% ARR in mortality. Six RCTs comparing NPPV to standard medical therapy showed an 18% ARR in the need for endotracheal intubation and a 7% ARR in mortality. Seven RCTs comparing NPPV with CPAP showed a non-significant 3% ARR in the need for endotracheal intubation and a 2% ARR in mortality. In studies including more hypercapnic patients, a subgroup analysis showed that NPPV did not lead to better outcomes when compared with CPAP. Neither of these techniques increased the risk for acute myocardial infarction. The authors concluded that the need for endotracheal intubation and mortality are decreased with the use of NPPV and CPAP in comparison to standard medical therapy for the treatment of acute cardiogenic pulmonary edema. Based on these results, CPAP could be considered as a first line therapy because NPPV did not demonstrate better efficacy and CPAP is the cheaper and easier to use option.

Masip et al., conducted a systematic review to evaluate the short-term effect of noninvasive ventilation on major clinical outcomes in patients with acute cardiogenic pulmonary edema. Fifteen RCTs comparing various techniques of noninvasive ventilation including CPAP and bilevel noninvasive pressure support ventilation (NIPSV) with conventional oxygen therapy were analyzed. Overall, noninvasive ventilation significantly reduced mortality rate by nearly 45% when compared with conventional therapy alone. However, results for reduction in mortality were significant for CPAP but not for NIPSV (although more studies were included in the CPAP...
analysis). Results for reduction in endotracheal intubation were significant for both techniques compared with conventional therapy alone. No significant differences in intubation or mortality were shown in studies that compared CPAP with NIPSV. The authors concluded that both CPAP and NIPSV reduce the need for intubation and mortality in patients with acute cardiogenic pulmonary edema. There was more evidence for CPAP, but there were no significant differences in clinical outcomes in studies directly comparing CPAP with NIPSV.

One observational study comparing the outcomes of 237 patients with COPD and acute respiratory failure was identified in the search. This was a retrospective survey of three cohorts of patients who upon ICU arrival were initially treated with either CPAP, standard medical therapy, or intubation. There was a significant reduction in the number of patients requiring intubation when initially treated with CPAP (16% versus 62% treated medically; p=0.001). There were also significant differences in length of hospital stay for the CPAP group versus those receiving standard therapy or who were intubated (5 days, 7 days, 8.5 days, respectively; p=0.001). Mortality risk was significantly higher for intubated patients and those given standard medical therapy when compared with those initially receiving CPAP. The authors concluded that initial therapy with CPAP in COPD patients with acute respiratory failure is associated with better outcomes compared with other treatment alternatives.
References summarized:

**Health technology assessments**
No literature Identified

**Systematic reviews and meta-analyses**


**Economic analyses and cost information**
No literature Identified

**Randomized controlled trials**
No literature Identified

**Observational studies**


**Guidelines and recommendations**
No literature identified

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Appendix – Further information:

Systematic reviews and meta-analyses


Randomized controlled trials


Observational studies


