The impact of pre-hospital non-invasive positive pressure support ventilation in adult patients with severe respiratory distress: A systematic review and meta-analysis

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Introduction

- Non-invasive positive pressure ventilation (NIPPV) has been shown to reduce mortality, intubation rates, and intensive care unit (ICU) length of stay (LOS) for patients admitted to hospital with acute cardiogenic pulmonary edema (ACPE) and acute exacerbation of chronic obstructive pulmonary disease (COPD)
- NIPPV is increasingly being used by Emergency Medical Services (EMS) for the treatment of respiratory distress in the pre-hospital setting

Objectives

Primary Objective

- To determine if out-of-hospital administered NIPPV for the treatment of adults (age ≥16 years) with severe respiratory distress reduces 30-day mortality compared to 'standard' therapy

Secondary Objectives

- To examine the effect of pre-hospital administered NIPPV on the need for invasive ventilation, intensive care unit (ICU) length of stay (LOS), hospital LOS and complications from NIPPV

Methods

- Electronic searches of Medline, EMBASE, Cochrane Central Register of Controlled Trials, and CINAHL were conducted and reference lists for relevant articles were hand searched
- Randomized controlled trials comparing the use of out-of-hospital NIPPV to 'standard' therapy in adults (age ≥16 years) in severe respiratory distress with a suspected diagnosis of ACPE, AECOPD, or acute asthma exacerbation were included
- Two reviewers independently screened titles and abstracts, assessed the quality of the studies, and extracted data
- Where appropriate, data were pooled using random-effects models and reported as risk ratios (RR) with 95% confidence intervals (CIs) and number needed to treat (NNT)

Results

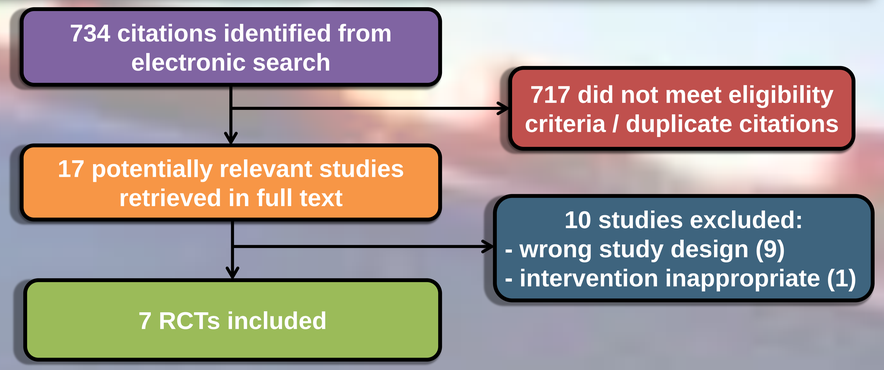

Figure 1. Flow diagram of included studies.

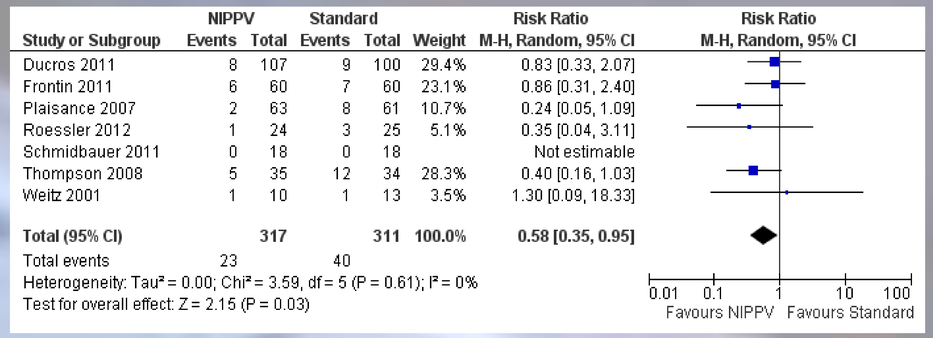

Figure 2. In patients treated with pre-hospital NIPPV, the pooled estimate showed a reduction in 30 day mortality (RR: 0.58; 95% CI: 0.35, 0.95; NNT=17)

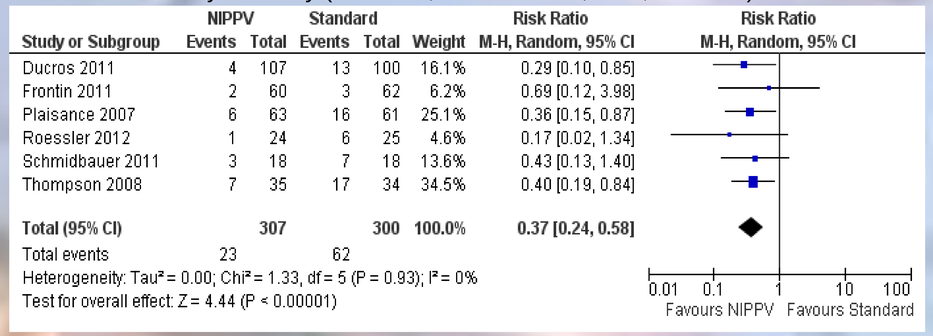

Figure 3. In patients treated with pre-hospital NIPPV, the pooled estimate showed a reduction in need for invasive ventilation (RR: 0.37; 95% CI: 0.24, 0.58; NNT=8)

Trial	Type of Disease	NIPPV (cmH_2O)	'Standard' Care	STD	TX
Plaisance (France)	ACPE	CPAP-7.5	Diuretics, O_2 NTG, CCB, ionotropes,	61	63
Frontin (France)	ACPE	CPAP-10	Diuretics, nitrates, O_2	62	60
Schmidbauer (Germany	AECOPD	CPAP-Unclear	O_2	18	18
Thompson (Canada)	Severe Resp Distress	CPAP-10	Diuretics, morphine, O_2, NTG, bronchodilators,	35	36
Weitz (Germany)	ACPE	BiPAP-12.5/5	Diuretics, NTG, morphine, O_2	13	10
Ducros (France)	ACPE	CPAP-7.5-10	Diuretics, nitrates, ionotropes, O_2	100	107
Roessler (Germany)	ACPE, AECOPD, pneumonia	CPAP-5-20	Bronchodilators, dex, opiates, Lasix, O_2	25	24

- 7 RCTs were included with a total of 632 patients; 313 in the 'standard' therapy group and 319 in the NIPPV group
- There was no difference in ICU or hospital LOS
- In the 2 studies that reported complications, 3 patients (1.0%) receiving NIPPV experienced emesis

Limitations

- No standard modality or treatment dose/length for administering NIPPV across the included RCTs
- Clinical heterogeneity as patients included had diagnoses which included asthma, COPD, and ACPE
- Future studies should aim to delineate the safety and efficacy of NIPPV for expanded disease processes such as asthma and pneumonia

Conclusions

- Pooled estimate showed a reduction in both 30-day mortality (NNT=17) and need for invasive ventilation (NNT=8)
- EMS systems should adopt NIPPV as the standard of care for the treatment of adult patients prehospital with severe respiratory distress