



Non-invasive Positive Pressure Ventilation (NPPV) for Acute Exacerbations of COPD: Evidence Base & How to Set up a Service

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Why use ventilatory assistance ?

- patients with COPD are prone to exacerbations of respiratory failure
- mechanical ventilatory assistance is useful in patients with respiratory failure
- in COPD, 16-35% of acute exacerbations are intubated
- overall mortality is high (19-29%)

Limitations of invasive ventilation

- requirement for sedation (& paralysis)
- nosocomial infection
- laryngeal/tracheal injury
- weaning difficulties
- progression to tracheostomy
- prolonged stay in ICU (cost)

Advantages of NPPV

- avoids intubation & ∴ potential complications
- better patient comfort
- coughing, speech & swallowing preserved
- little or no sedation required
- can be used where intubation inappropriate
- can be used away from ICU & potentially ↓ costs

Limitations of NPPV

- need patient co-operation
- patient must protect upper airway
- no direct access to airway (secretion clearance)
- risk of mask dislodgment
 - ⇒ inadequate ventilation
- not all patients tolerate NPPV (up to 20% fail)
- appropriately skilled staff required

Current Recommendations - NPPV in ARF

- Strong Evidence – Level A (multiple controlled trials)
 - Acute hypercapnic COPD
 - Acute cardiogenic Pulmonary Oedema – most evidence for CPAP
 - Immunocompromised patients
- Less strong – Level B (single controlled trials, multiple case series)
 - Asthma
 - Community Acquired Pneumonia in COPD patients
 - Facilitation of weaning in COPD
 - Avoidance of extubation failure
 - Post Operative Respiratory Failure
 - Do not intubate patients

Current Recommendations - NPPV in ARF

- Weak Evidence – (few case series, no benefit in controlled trials)
 - ARDS
 - Community acquired pneumonia - non COPD
 - Cystic fibrosis
 - Weaning – non COPD
 - OSA/ obesity hypoventilation
 - Trauma
- Not Indicated
 - Acute deterioration in DILD
 - Severe ARDS with multi organ failure
 - Post op – upper airway, oesophageal surgery

NPPV in acute exacerbations of COPD

- This is the best established application of NIV in acute respiratory failure

NPPV in COPD

- Mechanism of action
 - multifactorial, controversial and poorly understood
 - ↓ work of breathing
 - ‘rest’ respiratory muscles
 - ↓ respiratory muscle fatigue
 - ↓ dyspnoea
 - counter intrinsic PEEP
 - reverses acidosis
 - allows time for conventional therapy to work
 - avoid death by intubation

NPPV in acute COPD – early RCTs

Investigator	N	Approach	Δ ABG	↓ intubation	↑ survival
Bott 1993	60	nasal Vol	Yes	???	? yes
Kraemer 1995	23	nasal BiPAP	Yes	Yes 8/12 cf 1/11	No
Brochard 1995	85	face PSV	Yes	Yes 31/42 cf 11/43	Yes 12/42 cf 4/42

NPPV in acute COPD – Cochrane review

- 14 studies – various parts of world (n= 758)
 - all studies – patients with COPD and acute respiratory failure
- location of study
 - respiratory / general wards - 6
 - ICU- 5
 - step down, intermediate care, unknown

NPPV in acute COPD – results

- reduction in mortality - 48%
- reduction in intubation rates – 59%
- significant improvements in pH, PaCO₂, & PaO₂ & respiratory rate
- reduction in hospital length of stay > 3 days
- only 1 negative study – here less sick, & delay ~12 hours to commencement of NPPV

Use of NPPV in patients not for intubation

- has role in some who are unsuitable /declined intubation
- BUT care not to just prolong the dying process
- need to inform patient & family -is a form of life support
- allows relief of dyspnoea, may improve outcomes
- studies 1992 & 1994 - patients, mostly COPD & ARF
 - ~ 60% successfully supported and weaned
- 2001 – prospective study of 113 DNI patients
 - survival to hospital discharge was 52% for COPD

NPPV – How to Make it work in ARF

- Patient factors
 - diagnosis
 - clinical characteristics
 - lower APACHE score
 - no pneumonia
 - pH > 7.10, PaCO₂ < 92mmHg
 - better neurological state
 - good initial response to NPPV

NPPV – How to Make it work in ARF

- Staff
 - need adequate training
- Site for NPPV
 - need to be able to monitor patient properly
 - need expertise in intubation – especially with conditions where failure more likely e.g. asthma

Non-invasive Positive Pressure Ventilation in the Respiratory ward



Austin Health - ward NPPV guidelines

- NPPV can only be commenced following review by the Respiratory, Emergency Department or ICU Registrar
- decision re whether patient is for invasive ventilation is made, documented & discussed with patient and family
- patient must be transferred to the respiratory ward
- establish reportable observation parameters
- if patient not improving within 20 minutes then consider ICU transfer

Austin Health - ward NPPV guidelines

- Application of NPPV is competency accredited
- Staffing
 - Usual ratio is a 1:2 nurse patient ratio
 - If clinically indicated a 1:1 nursing ratio may be considered or patient transferred to ICU

Contraindications

- patients requiring >50% oxygen
- thoracic / gastric surgery / pneumothorax
- patients unable to maintain patent airway / clear secretions
- significant hypotension induced by NPPV therapy
- fractured base skull / facial fractures / ↑ Intracranial pres
- respiratory arrest

Interfaces:-Nasal & Full Face masks



NPPV using a BiPAP & VPAP



Implementation - Hypercapnoeic RF

- sit patient upright & explain procedure
- commence and titrate up to **maximum tolerated level**
- full face masks get better control of leaks
- apply chin strap if required / instruct patient to close mouth
- apply oxygen to machine end of tubing if required

Monitoring

- Observations
 - BP, RR, HR & rhythm, O2 saturation, conscious state
 - Treatment tolerance, complications
 - Initially, 15 minutely for 1 hour, 30 minutely for 2 hours, Hourly for 2 hours, then 4 hourly
- ABGs – measured prior to commencement, at 1 hour, within 1 hour of setting changed, then as clinically needed

Weaning in Acute COPD Exacerbation

- Aim to remove NPPV within 48hours
- weaning is commenced
 - once reversal of acute factors & improved ABGs
 - after consultation with medical team
- weaning carried out during day initially and then night
- ↑ing time off ventilation rather than ↓ing pressures
- monitor clinically and with ABGs as required

Conclusion

- clear evidence for use of NPPV in suitable patients with respiratory failure secondary to exacerbations of COPD
- NPPV can be applied in appropriate non ICU settings
 - need fully trained & experienced staff
 - appropriate equipment and support
 - guidelines can facilitate this