Recent Advances in Respiratory Medicine

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Non Invasive Ventilation (NIV)

NIV

- Noninvasive ventilation (NIV) refers to the administration of ventilatory support without using an invasive artificial airway (endotracheal tube or tracheostomy tube).

NIV

- NIV was first used for the treatment of hypoventilation at night in patients with neuromuscular disease.

- This has proved to be so successful that it has become widely accepted as the standard method of non-invasive ventilation used in patients with chronic hypercapnic respiratory failure caused by chest wall deformity, neuromuscular disease, or impaired central respiratory drive.

- Non-invasive ventilation (NIV) in the management of acute type 2 respiratory failure in patients with chronic obstructive pulmonary disease (COPD) represents one of the major technical advances in respiratory care over the last decade.

NICE recommends that NIV be available in all hospitals admitting patients with COPD. This has led to a rapid expansion in the provision of NIV services, with over 90% of UK admitting hospitals offering this intervention.

NIV Indications:

- Hypercapnic respiratory failure secondary to chest wall deformity (scoliosis, thoracoplasty) or neuromuscular diseases
- COPD with a respiratory acidosis pH 7.25–7.35 (H^+ 45–56 nmol/l)
- Cardiogenic pulmonary edema
- Weaning from tracheal intubation

NIV in COPD

Respiratory Failure

- Respiratory failure is defined as a failure to maintain adequate gas exchange and is characterized by abnormalities of arterial blood gas tensions.

Type 1 failure : Pao_2 of <8 kPa with a normal or low $Paco_2$.

Type 2 failure : Pao_2 of <8 kPa and a $Paco_2$ of >6 kPa.

- Acute HRF:

  High $Paco_2$, low pH, and normal bicarbonate.

- Chronic HRF:

  High $Paco_2$, normal pH, high bicarbonate.

- Acute-on-chronic HRF :

  High $Paco_2$, low pH, high bicarbonate

COPD Exacerbations

- increase the respiratory load
- increasing hyperinflation with decreased diaphragmatic excursion and strength
- increase intrinsic PEEP
- ineffective or inadequate tidal volume generation, respiratory patterns, and increased respiratory frequency.

NIV

unloads the respiratory muscles by

- Increasing tidal volume.
- decreasing the respiratory rate and diaphragmatic work of breathing.
- which translates to an improvement in oxygenation, a reduction in hypercapnia, and an improvement in dyspnea.

NIV decreases

- risk of intubation
- hospital mortality
- length of stay

most pronounced in patients with more severe COPD exacerbations having pH of less than 7.30.

- intubation rates decreased by 34%
- mortality reduction of 12%
- absolute reduction in the length of stay by 5.59 days

NIV mode

- Bi-level pressure support ventilators are simpler to use, cheaper, and more flexible than other types of ventilator currently available; they have been used in the majority of randomised controlled trials of NIV and are recommended when setting up an acute NIV service. (C)

NIV settings for bi-level pressure support in a patient with acute hypercapnic respiratory failure due to COPD

Mode	Spontaneous/timed
EPAP	4–5 cm H_2O
IPAP	12–15 cm H_2O (to be increased as tolerated to 20 cm H_2O)
Triggers	Maximum sensitivity
Back up rate	15 breaths/min
Back up I:E ratio	1:3

NIV in Cardiogenic Pulmonary Edema

Respiratory failure in CHF

- combination of pulmonary vascular congestion, interstitial edema, and alveolar edema.
- leads to hypoxemic respiratory failure, and patients with CHF who further deteriorate manifest hypercapnic respiratory failure.

CPAP

- recruits alveoli
- increases functional residual capacity
- thereby decreasing the work of breathing,
- improving ventilation-perfusion relationships, and eventually correcting hypoxemia and hypercapnia.
- Positive intrathoracic pressure decreases preload and left ventricular afterload

Meta analysis of CPAP shows:

- risk reduction in intubation of 60%
- decrease in mortality rate of 47%
- NIV has also demonstrated a risk reduction in intubation rates of 52% (RR, 0.48; 95% CI, 0.34-0.76), but not for mortality rates

NIV After Extubation

- More than 20% of patients require re-intubation on post extubation
  - increased respiratory load
  - hyperinflation,
  - diaphragmatic dysfunction
  - increases in preload and afterload

All factors contribute to hypercapnia, hypoxemia, and eventual respiratory failure

NIV in more than 500 patients (mostly COPD patients) shows,

- reduced mortality rates by 45%
- decrease in VAP rates by 71%
- Reduced duration of ICU stay by 6.27 days and hospital days by 7.19 days compared with a conventional weaning approach.
- Re-intubation rates were not decreased.

Factors associated with success in NIV

- High $Paco_2$ with low A–a oxygen gradient
- pH 7.25 – 7.35
- Improvement in pH, $Paco_2$, and respiratory rate after 1 hour of NIV
- Good level of consciousness

Factors associated with Failure of NIV

- High APACHE score
- Pneumonia on chest radiography
- Copious respiratory secretions
- Edentulous , Poor nutritional status
- Confusion or impaired consciousness

Other Indications

- Community-acquired pneumonia
- Immunocompromised patients and hypoxemic respiratory failure
- Asthma
- Post operative
- Rib fracture
- Do not intubate status
- ARDS
- SARS
- Neuromuscular Diseases
- Obesity Hypoventilation syndrome
- Idiopathic pulmonary fibrosis

NIV not indicated in:

- Impaired consciousness
- Severe hypoxemia
- Patients with copious respiratory secretions

Complications of NIV

- Facial and nasal pressure injury and sores
- Gastric distension
- Dry mucous membranes and thick secretions
- Aspiration of gastric contents
- BAROTRAUMA (less risk with noninvasive ventilation)
- Hypotension related to positive intrathoracic pressure (support with fluids)

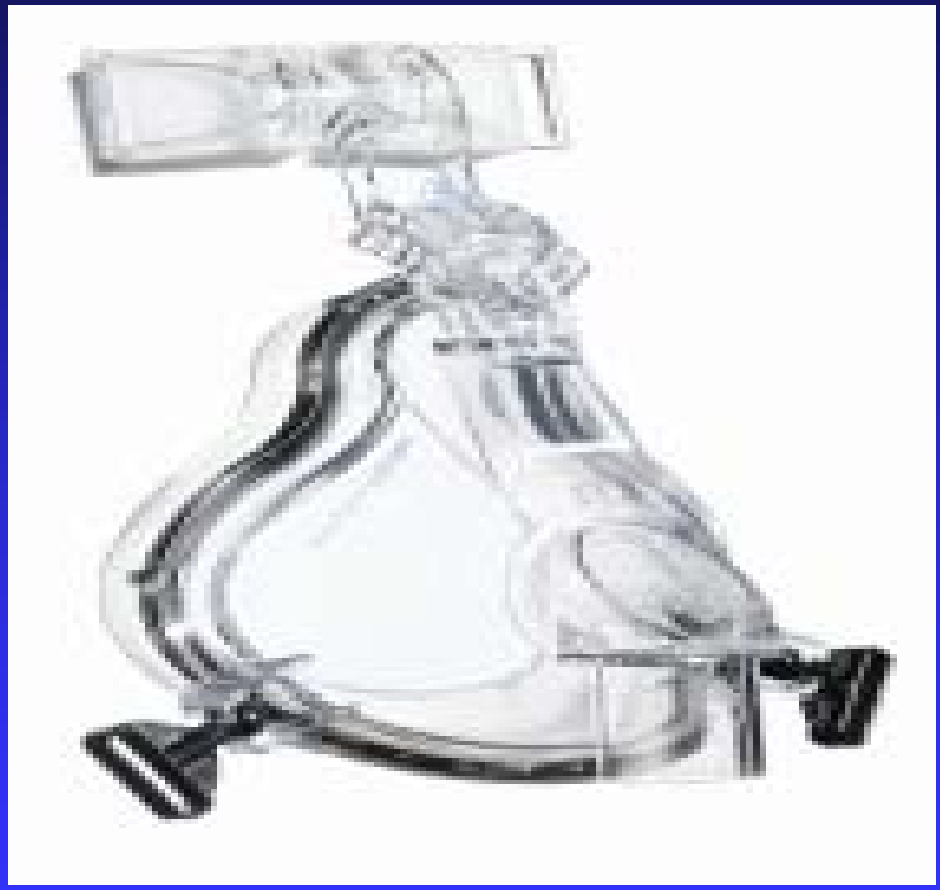
Summary

- NIV is a safe, versatile and effective technique that can avert side effects and complications associated with endotracheal intubation.
- NIV has been recommended as first-line therapy in the management in COPD patients with hypercapnic respiratory failure.
- Noninvasive ventilation reduces the need for intubation, mortality, complications, and length of stay in patients with COPD.

NIV success depends

- type and severity of acute respiratory failure
- underlying disease
- the location of treatment
- experience of the team.
- time factor

Masks



ASTHMA NAEPP 2007

- New tools to assess asthma control & predict risk
- monitor patients for comorbidities
- Potential new biomarkers and exhaled nitric oxide
- Monoclonal antibodies and bronchial thermoplasty were among the new therapies explored in asthma

New Drugs

- Anti Ig E Omalizumab (Xolair) in moderate persistent asthma patients
- Omalizumab is a recombinant DNA-derived humanized IgG1κ monoclonal antibody that selectively binds to human immunoglobulin E(IgE).
- FDA approved in recurrent exacerbation in allergic patients.
- Available in Injectable form
- Dose 150mg 375mg s/c every 2-4 weeks above 12 yrs age patient

LTRA (Montelukast)

- Role not as steroid sparing drug
- Alternative therapy
- Good response in smokers, AIA, EIA
- Good indication in children 4yrs n young

- Exhaled FeNO still controversial issue on diagnosing and management of asthma.

- FE_{NO} levels were influenced by sex, atopy, and smoking status, with higher FE_{NO} levels reported in males, allergic subjects and nonsmokers.

Environmental Role

- Pre birth and childhood (genetics, *in utero* tobacco exposure, breastfeeding)
- home (outdoor and indoor air pollutants)
- workplace (health care workers)

Awaiting Clinical Trials

Immunomodulators and novel therapies (bronchial thermoplasty)

Several recent Monoclonal antibody studies have proven that biologic therapy does not work unless the correct patients are studied.

Finally, asthma biomarkers and asthma pharmacogenetics.

THANK YOU