Non-invasive ventilation

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Aims & Objectives

• Discuss the history of intervention
• Define what is meant by NIV
• Indications for NIV
• Contraindications of NIV
• Implications for NIV
• The Future
History of NIV

- And the Lord God formed man of the dust of the ground and breathed into his nostrils the breath of life and man became a living soul. -Genesis

- First evolved with negative pressure ventilation in 1876 by Woillez. 1889 Alexander Graham Bell designed a prototype of an iron lung to use with a newborn.

- Polio epidemics of 1930’s, 40s & 50s propelled the development of iron lung.

- Negative pressure ventilation fell out of favour in 1960s but in the past decade the use of positive pressure via a face/nasal mask was fuelled.
Definition

- Delivery of ventilatory support without the need of an invasive artificial airway.
- Eliminates the need for intubation or tracheostomy and preserve normal swallowing, speech and cough mechanisms.
Definition contd.

- **Negative-pressure ventilation**
  - Lower the pressure surrounding the chest wall during inspiration and reversing the pressure to atmospheric level during expiration. These devices augment the tidal volume by generating negative extrathoracic pressure.

- **Non-invasive Positive-pressure ventilation**
  - Provided by a volume ventilator, pressure-controlled ventilator, a bi-level positive airway pressure (BiPAP) or a continuous positive airway pressure device (CPAP).
Mechanisms of Action

• Decreases the work of breathing (WOB) and improves alveolar ventilation and simultaneously resting musculature
• Improvement in gas exchange due to increased alveolar ventilation
• Expiratory pressure (PEEP/CPAP) decreases WOB
Negative Pressure Ventilation

- Back in vogue
- Iron Lung & Hayek oscillator (Hayek & Sohar 1993)
- Method of ventilation for patient with progressive neuromuscular disease, severe chest deformities & broncho-pulmonary dysplasia (Knebel et al 1997)
- Augmentation of cardiac output in child with dysfunctional pulmonary blood flow (Shekerdemian & Bohl 1999) i.e. Fontan circulation
Indications for NIV

- Acute Respiratory Failure
  - Primary respiratory failure
    - Infection
    - Asthma
  - Cardiovascular pathology
    - Pulmonary oedema
    - LCOS
• **Chronic Respiratory Failure**
  – Primary respiratory pathology
    • Malacia
    • Chronic Lung Disease
    • COPD
  – Neuromuscular disorders
    • Duchene Muscular Dystrophy
    • Myasthenia Gravis
• Acute on Chronic
  – superimposed infection
  – Acute worsening of condition
What does the Literature say?

• Neonates
  – Davis, Davies & Faber (2001)
  – Davis & Henderson-Smart (2000)

• Infants & Children
  – Bernet et al (2005)

• Adults
  – Sharma (2006)
Contra-indications

- **Airway**
  - Upper airway obstruction
  - Aspiration Risk
- **Cardiovascular Arrest**
- **Cardiovascular**
  - Haemodynamic instability
  - Unstable arrhythmias
- **Neurological**
- **Anatomical deformity**
Equipment required

- Flow driver/ NIV machine
- Face/Nasal Masks
  - Choice & Fit
- Humidification System?
- Supplemental oxygen
- Monitoring
Settings

- Continuous positive airway pressure (CPAP)
- Pressure Limited
  - Pressure Control
  - Pressure Support
  - Bi-level positive airway pressure (BiPAP)
- Trigger sensitivity
Other Considerations

- Explanations to child (& family) to improve concordance/ compliance
- Patient comfort
- Abdominal distension
- Pressure area care!
- Physiotherapy
- Monitoring
Termination of NIV

• Progression to invasive ventilation
• Clinical improvement
• Individualised weaning plan
Future

- NIV ventilators/flow drivers that can be used on transportation/retrieval
- Nurse led service
- Helmet-delivered NIV (Piastra et al 2004)
- Facility the use of NIV at home for children.
Any Questions?
THANK YOU!