Noninvasive Ventilation: Where are we going?

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Disclosures

• Research Grants
  – Breathe Technologies
  – Fisher Paykel

• Advisory Board
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  – Fisher Paykel

• Consultant
  – Breathe Technologies
  – Respironincs
  – ResMed
  – Vapotherm
Outline

• Where have we been?
• Where are we now?
• Where are we going?
  – Educational needs
  – Technological needs
  – Adjunctive approaches
    • HFNC
    • ECCO$_2$R
“It’s tough to make predictions, especially about the future.”
Where have we been?
Where have we been?

- Copenhagen polio epidemic 1952
- Nasal ventilation for resp failure mid 1980s
- Meduri Face Mask vent for ARF 1989
- Brochard Face Mask PSV for COPD 1991
- Bott, Kramer, Brochard RCTs COPD mid 1990s
- Evidence for main, lesser indications ’90s – present – RCTs, meta-analyses, guidelines
- Technological advances, Epidemiology
NIV Epidemiology – Where have we been?
Increasing Use of NIV in French and US ICUs

Carlucci et al, AJRCCM, 2001  Demoule et al, ICM, ’06; Ozsancak Urgurlu et al, Chest ‘13
International Study of Mech Vent: NIV Use in 23 Countries

Esteban A et al. AJRCCM 2008
Increasing Use of NIV for COPD in US (> $7 \times 10^6$ admissions)

Chandra D et al, AJRCCM 2012
Diminishing Mortality Overall

Concern re overzealous use, delayed intubation

Chandra D et al, AJRCCM 2012
Use of NIV increased for COPD, CPE and PNA (Massachusetts and Rhode Island, USA) 2002-2007

% of Vent starts for COPD Exacerbations, CPE/CHF, PNA and ARDS treated with NIV

Trends not all rosy!

- Enormous variation in use between institutions – Lindenauer P et al, JAMA IM 2014

- UK national audit – NIV not used in 39% of ICUs – Kaul S et al, COPD 2009

- Korean survey – 2 of 24 univ hospitals using it – only 4% of vent starts

- US VA survey – 2/3 of resp therapists opined that NIV used < ½ of indicated cases – Bierer GB et al, Respir Care 2009
Where are we?
Main Indications for Acute NIV

Strong Evidence
Acute hypercapnic RF (COPD)
Cardiogenic pulmonary edema
ARF in immunocompromised
Options for Acute NIV

Weaker evidence

Asthma
Community Acquired Pneumonia (COPD)
Extubation failure (COPD)
Hypoxemic Respiratory Failure
Do-not-intubate pts (COPD and CHF)
Postoperative Respiratory Failure
Interfaces for NIV

Kwok H et al, CCM 2003
Developments in Mask Technology
Helmet

Mainly for CPAP
High flow to minimize rebreathing
Noisy and expensive
Not approved by FDA in US for NIV
NIV modes on Critical Care Vents

- Leak compensation
- Adjustable Rise Time
- Inspiratory Time Limit
- Silence nuisance alarms
- Need adjustments if leaks

Ferreira, Chest ‘09
Where are we going?

• **Education – Knowledge**
  
  • Use it smarter – Right patient, right time, right approach, right technology
  
  • Optimal use – are we reaching saturation point?
  
  • Avoid NIV failure, delayed intubation
  
  • Expanded evidence base – Role in ARDS?, Peri-operative setting?
Where are we going?

• **Technology**
• More comfortable interfaces – more choices, use of nasal route?
• Multi-function ventilators
• Use of Bernoulli principle?
Where are we going?
High Flow Nasal O2

• Heated, humidified oxygenated gas at flows up to 60 L/min

• Comfortable for most patients

• Clears dead space in upper airway

• Enhances mucociliary clearance

• Provides PEEP - roughly 1 cm H2O for each 10 L/min flow

• May help to reduce work of breathing and serve as more tolerable supplement for NIV (NIV lite?)
Where are we going?
EC CO2 Removal

Avoid intubation in NIV failure?
Facilitate extubation?

Burki N et al, Chest 2013
Summary: NIV Where are we going?

- Smarter applications
- Uptake at laggard institutions
- Deepening evidence base and broader applications
- Advancing technology to enhance comfort, tolerance
- New approaches to avoid need for intubation including HFNC and ECCO2R, which may narrow use of NPPV
THE FUTURE AIN'T WHAT IT USED TO BE.

Yogi Berra