

# Running a Home Ventilation Service: A physician's perspective

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- Requirements for home NIV service
- What service do I run?
- Physiology
- NIV
- Investigating patients
- When to start NIV
- Case studies

# Requirements

- Good Clinical Respiratory Nurse Specialist
- Funding

# What service do I run?

- Assisted ventilation service
- NE Glasgow
- Some tertiary referrals
- 1 Clinical session (+ 3 Sleep sessions)
- 1 Full time Clinical Nurse Specialist
- 3 full time Sleep physiologists
- Work very closely with Dr S Banham at GGH (Sr McGlone)

# Current work load

- 91 patients attending GRI Breathing Support Clinic
- 74 (81%) currently on nocturnal ventilatory support
- Chest bellows Disease 22 (24%)
- COPD/Overlap 6 (6%)
- Neuromuscular 9 (10%)
- Obesity Hypoventilation 54 (60%)

- Specialist Regional Neuromuscular Service Gartnavel General Hospital run by Dr Steve Banham
- This group very different patient group from the patients I deal with
- Often require 24 ventilation
- Tracheostomies
- Battery back up
- 2 ventilators

# Physiology

- Although the approach to these different disease may not be entirely uniform, these disorders are fundamentally a HYPOVENTILATION derangement
- Not surprisingly, oxygen therapy on its own is not only ineffective in relieving symptoms, it can also be dangerous causing marked CO<sub>2</sub> retention

# What is NIV

- Use of close fitting mask systems to assist voluntary ventilation in conscious patients, usually at night when adequate ventilation is most at risk , but NIV can provide 24 hour life support ventilation in patients with neuromuscular disease

# How does it work?

- Several theories exist and are likely to be complimentary
  - Respiratory muscle rest
  - Resetting CO<sub>2</sub> sensitivity of central ventilatory controller
  - Changes in pulmonary mechanics
  - Changes in sleep fragmentation
  - Alterations in sleep architecture
  - Increase lung volume
  - Reduce dead space
  - Improve compliance

# Does it work?

- Nocturnal NIV in patients with chronic respiratory failure secondary to restrictive chest wall abnormalities is associated with prolonged survival
- Evidence not so good in those with only COPD

# Patients requiring domiciliary NIV

- Neuromuscular disease
- Restrictive chest wall disease
  - Kyphoscoliosis
  - Previous pneumonectomies
    - Chest Bellows Disease
- Obesity hypoventilation
- COPD/Overlap syndrome

#### **Box 4 Indications for referral for consideration of long term NIV**

- Failure to wean from NIV
- Acute hypercapnic respiratory failure secondary to:
  - Spinal cord lesion
  - Neuromuscular diseases
  - Chest wall deformity (e.g. scoliosis, thoracoplasty)
  - Morbid obesity (BMI >30)
- COPD with:
  - Recurrent AHRF (>3 episodes) requiring treatment with NIV
  - Intolerance of supplementary oxygen (because of CO<sub>2</sub> retention) with symptomatic sleep disturbance

# Investigations

**Table 8—Tests Used to Assess Alveolar Hypoventilation**

Test	Routine	Select
Clinical presentation		
History and physical examination	X	
Arterial blood gas analysis ( $PO_2$ , $PCO_2$ , pH)		
Daytime	X	
Sleep		X
Evaluation of ventilatory control		X
Hypoxic challenge		
Hypercapnic challenge		
Mouth occlusion pressures		
Respiratory mechanics		
Spirometry	X	
Respiratory muscle pressures		
Mouth (global)	X	
Diaphragm		X
Pattern of breathing	X	
Sleep studies		
Nocturnal trending pulse oximetry	X	
Nocturnal $PCO_2$ monitoring		X
PSG		X



# Investigations

- Depends on presentation
- Acute acidotic type 2 RF
  - Initiate immediately
  - If not able to wean, may not be able to take off NIV
  - Transcutaneous CO<sub>2</sub> (TOSCA) monitoring useful

# Investigations

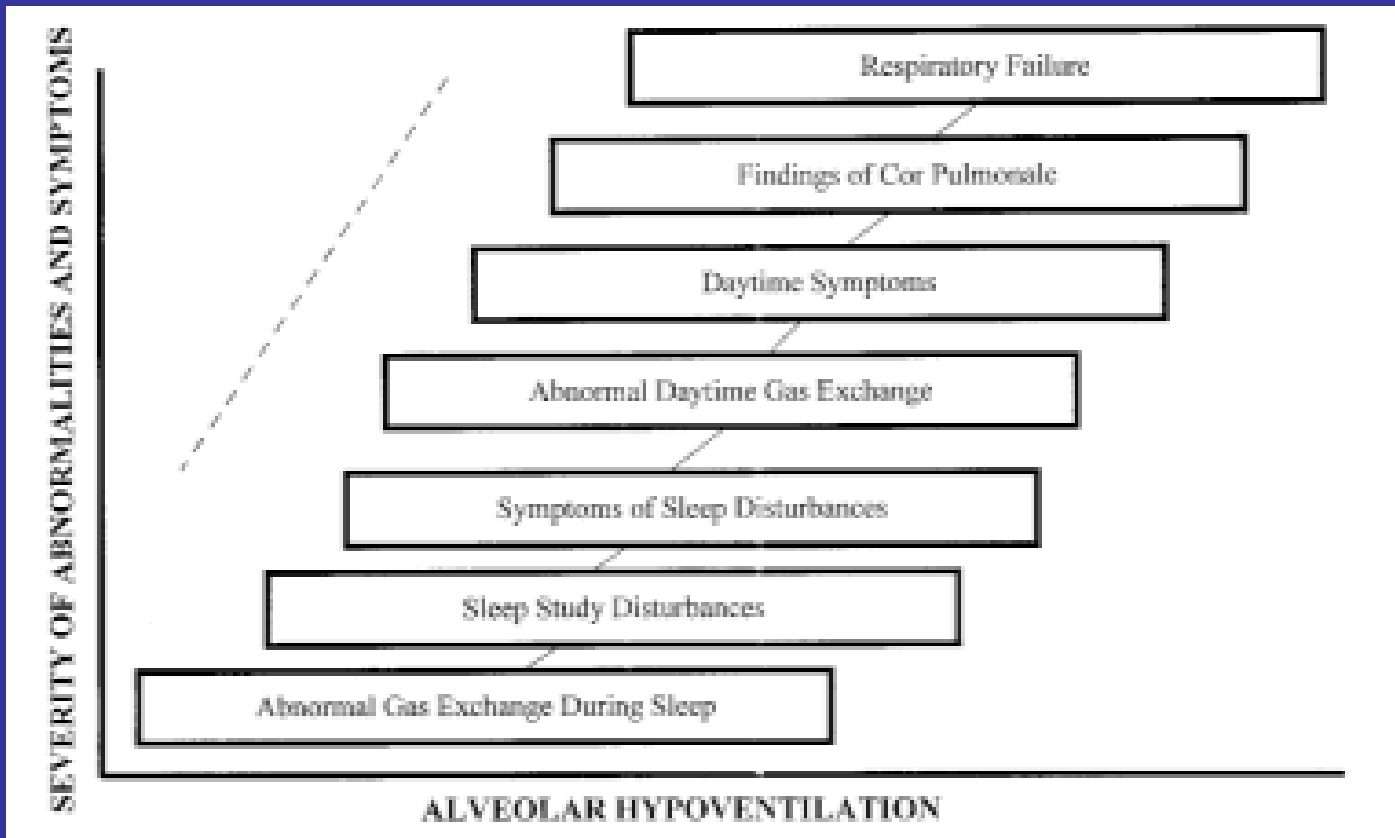
- Compensated type 2 RF
  - Can take a bit more time
  - 5 Channel sleep study
    - Oximetry
    - Airflow
    - Abdominal/Chest wall bands
    - ECG
    - Actigraphy
  - TOSCA

# When to start NIV

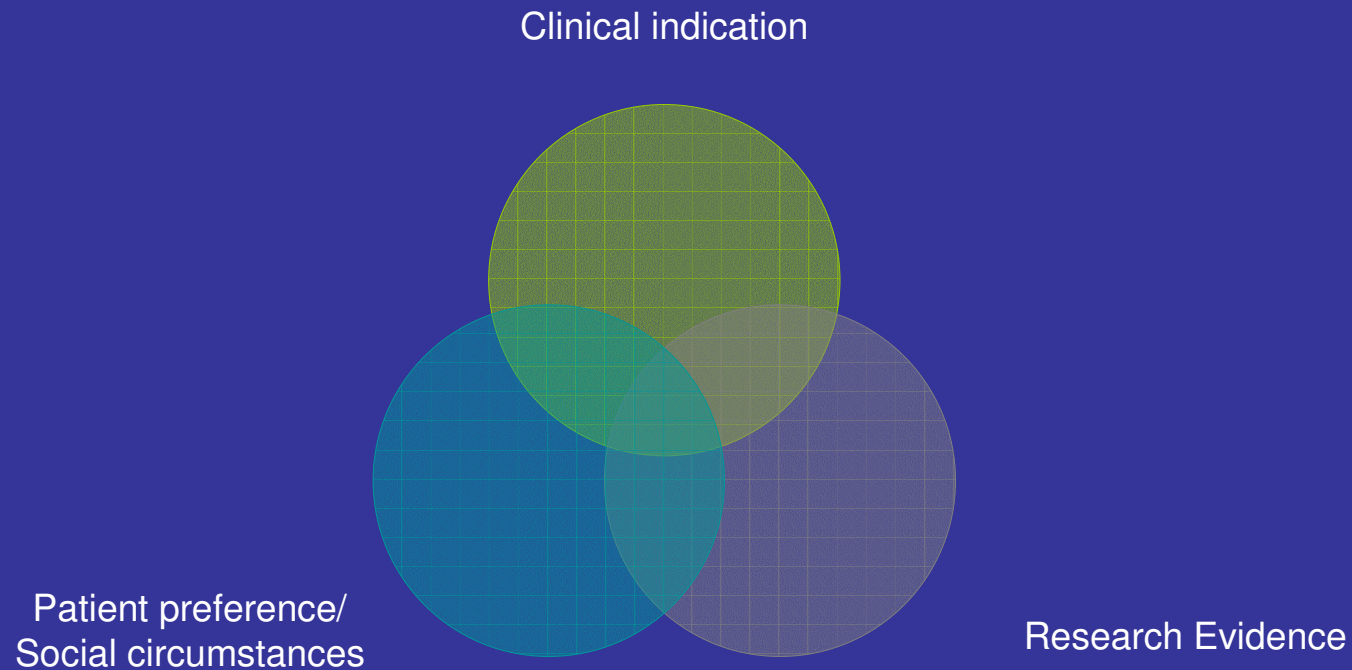
- Difficult decision at times
- Slowly progressive vs rapidly progressive conditions
- Indications often different in neuromuscular conditions (Sr McGlone)
- Daytime normocapnic but nocturnal hypercapnia

# When to start NIV

- Raised daytime pCO<sub>2</sub>
- After episode of acute respiratory failure
- Nocturnal hypoventilation
  - Sleep disturbance
  - Daytime hypersomnolence
  - Excessive fatigue
  - Morning headaches



# Decision making



# Initiation onto NIV

- Day case in straightforward cases
  - Kyphoscoliosis
  - OHS
- Short elective admission
  - Investigations
  - Initiation
  - Education

# Modes of ventilation

- Pressure pre-set
  - Pressure support
  - Pressure control
- Volume pre-set
  - Volume control
    - Good with very restrictive chest walls□

# Monitoring of patients

- Telephone communication post discharge
- Early initial review
- Capillary blood gases
- TOSCA

# Problem solving

- Interfaces issues
- Mouth leak
- Ongoing hypoxia
- Deteriorating pCO<sub>2</sub>
  - Leak
  - Increasing weight
  - Increasing restriction
    - Pleural thickening

# Problem solving

- Neuromuscular patients have a whole range of different problems
- Should be looked after in specialist centres
- Secretion management
- ?tracheostomy
  
- Sr McGlone

# Case 1

- 56 yr old man
- Admitted to orthopaedics with suspected fractured left hip
- Too large for xray confirmation
  
- Grossly obese
- BMI > 60 kg/m<sup>2</sup>
- Drowsy

# Case 1

- On closer questioning:
- Terrible snorer
- Excessive daytime somnolence
- Early morning headaches

# Case 1

- Had had a lot of opiates for pain control
- ABGs
  - H<sup>+</sup>                    67 nmol/l
  - pCO<sub>2</sub>                14 kPa
  - pO<sub>2</sub>                    8 kPa
  - HCO<sub>3</sub>                49 mmol/l

# Case 1

- Not well enough for much investigations
- Clinically correct build for OHS
- Commenced on NIV acutely
- ABGs improved
- Unlikely to be able to wean

# Case 1

- TOSCA monitoring
  - Ongoing desaturations
  - Classical saw-tooth pattern
  - Low-ish baseline
  - CO<sub>2</sub> mean 7kPa
- Increased EPAP
- Next TOSCA much improved

# Case 1

- Discharged home after 8 weeks
- Weight down by 17 stone
- Much more alert during the day
  
- No immediate problems with NIV at home
- Review 4/52 post discharge

## Case 2

- 67 yr old lady
  - Ex-smoker 3 yrs
  - Diagnosis of COPD
  - LTOT
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- Frequent admissions with decompensated type 2 RF secondary to COPD

## Case 2

- Respiratory nurses at a loss of what to do to keep her at home
- Further admission to GRI requiring acute NIV
- Approached breathing support service for consideration of long-term NIV

## Case 2

- Evidence for long-term NIV in COPD is poor
- Studies however small and only 1 has shown a benefit of LTOT and NIV
- Patients in studies were not particularly hypercapnic
- NIV only given for 2 week period
  - Experience with CPAP suggests longer time required

## Case 2

- Trial of NIV initiated
  - Previously tolerated Acute NIV well
  - Managing independently with NIV quickly
  - CO<sub>2</sub> dropped
  - Felt brighter
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- No further hospital admissions until died at home 11 months later

# Conclusions

- Variety of indications for long-term NIV
- Neuromuscular patients have a whole host of different problems
- Daytime hypercapnia or episode of decompensated type 2 RF main indicators for domiciliary NIV
- Patients must have good family support or be independent in use of NIV
- Good Respiratory Clinical Nurse Specialist vital