

Home Mechanical Ventilation



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What is Long Term Ventilation?

- * LTV is the provision of respiratory support to individuals with non-acute respiratory failure
- * Progression of expected disease – Genetic disorders, inherited and acquired neuromuscular disorders
- * Failure of weaning from acute respiratory support
- * It does not require the sophistication of ICU setting

Conditions known to benefit or could benefit from LTMV

Known

- * Kyphoscoliosis
- * Spinal cord injury \geq C4, Bilateral diaphragm paralysis
- * MND, Post Polio, Spinal muscular atrophy (SMA)
- * Duchenne, Beckers, Myotonic, Pompe's
- * Central Alveolar Hypoventilation
- * Obesity hypoventilation

Possible

- * Cardiac failure
- * Stroke
- * Suppurative Lung disease

What stops you from breathing?

- * Fatigue – Energy supply < Energy demand

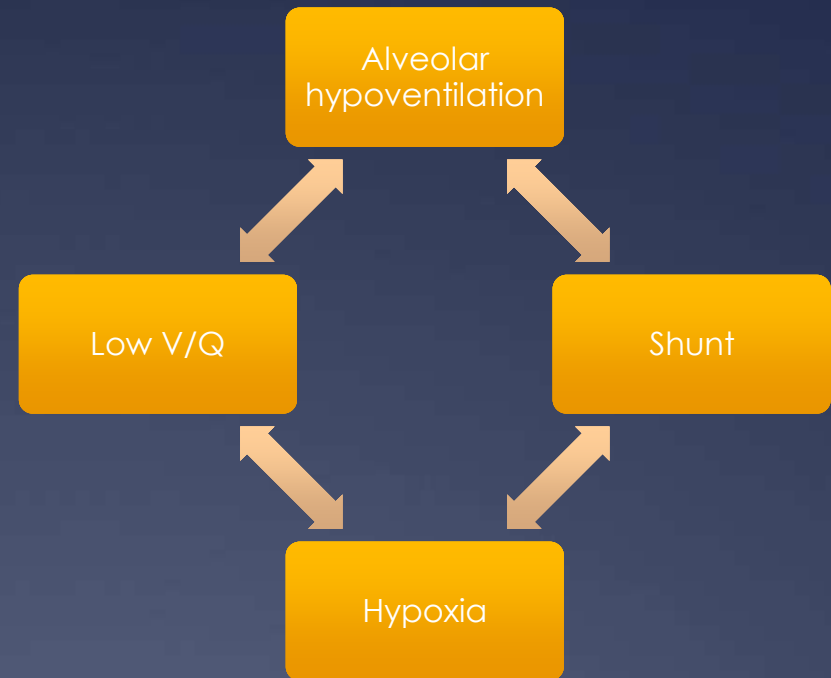
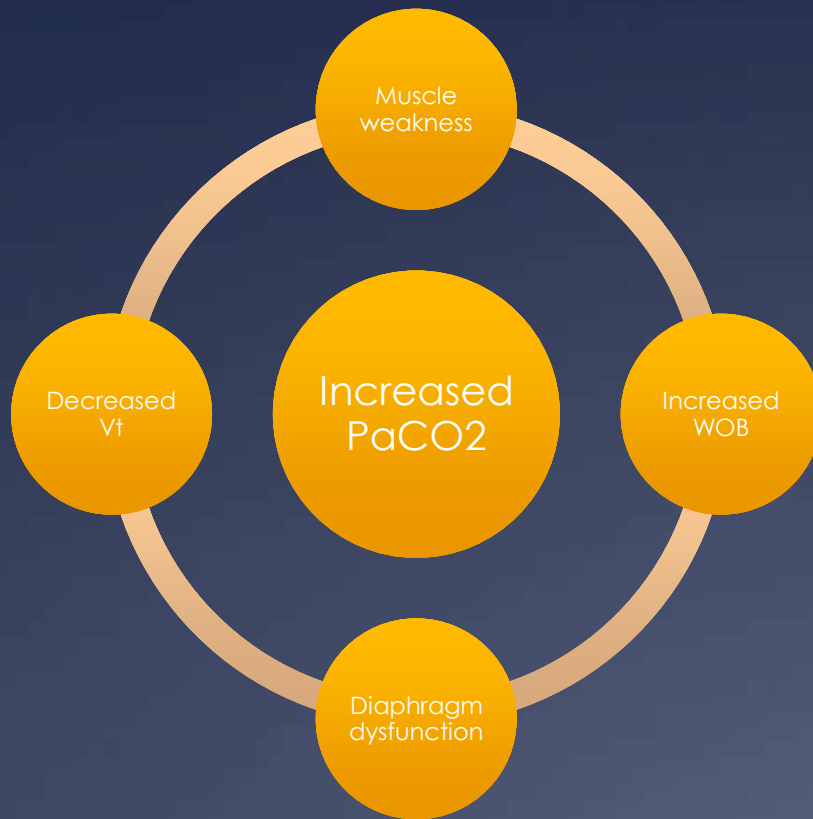
Energy supply depends on

- * Inspiratory muscle blood flow
- * Blood energy and O₂ substrate
- * Cellular function to extract and use energy

Energy demands depend on

- * Pressure required, time of work, efficiency of muscles and breathing system

Lungs go up and down...

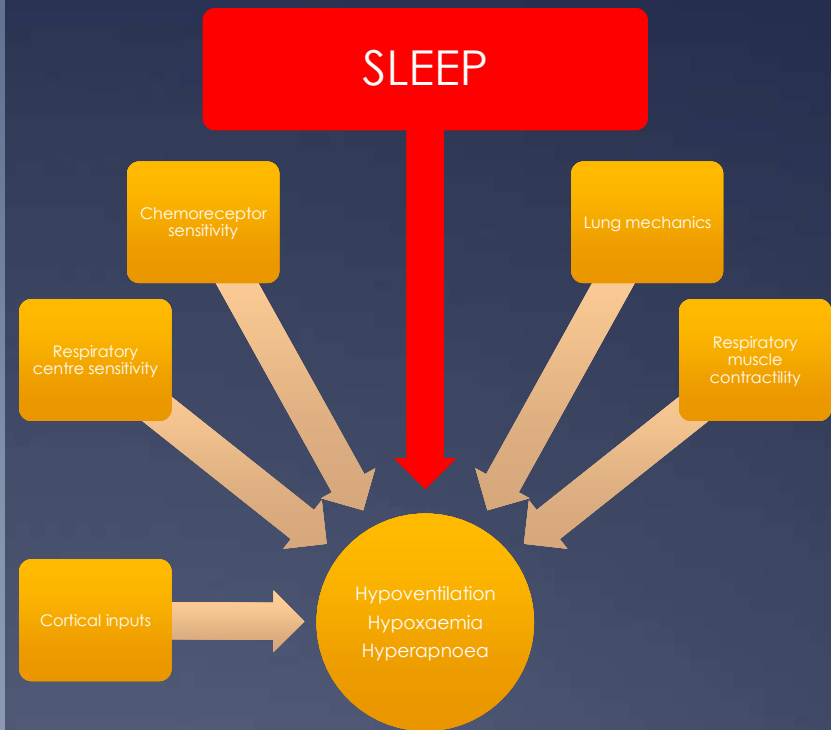


When does respiratory failure develop

Restriction

- * Principally a restrictive lung problem
- * Failure to move enough air in and out
- * In different stages of sleep breathing is progressively reduced

Sleep



Presentation of Respiratory Failure

Expected

- * Increasing SOB
- * Orthopnoea
- * Increased frequency and severity of chest infections
- * Poor sleep
- * Headache
- * Daytime somnolence
- * Weight loss / decreased appetite

Emergency

- * Unable to wean from acute ventilatory support
- * Cor pulmonale

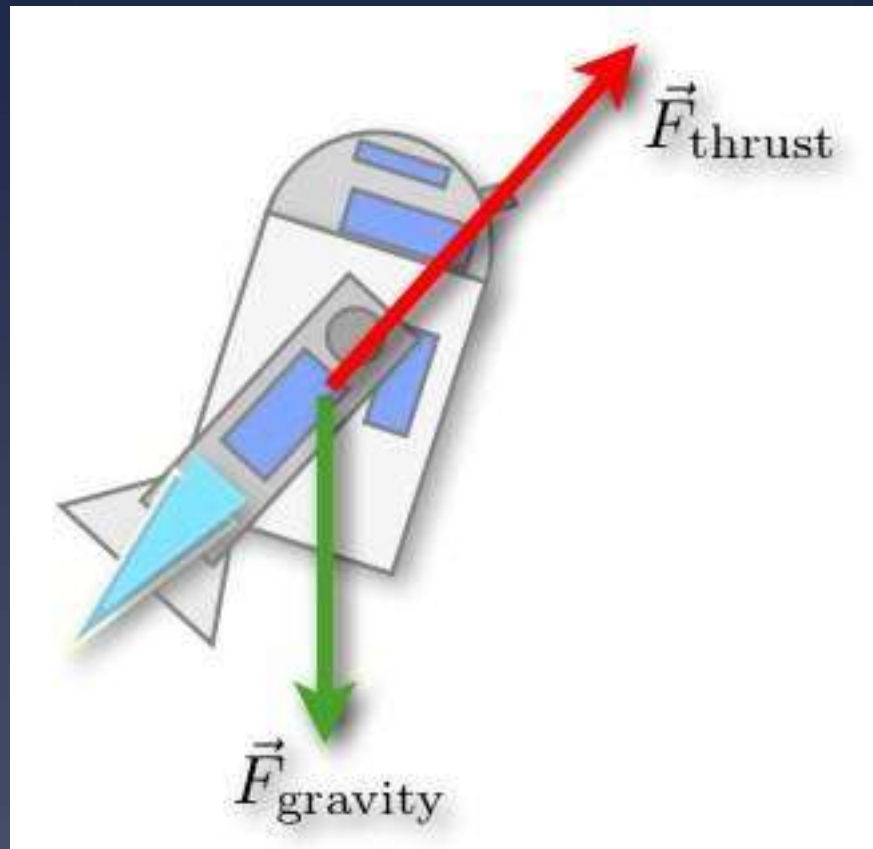
Aims and Goals

Aims

- * Improved gas exchange
- * Optimized lung volume
- * Reduced work of breathing
- * Correct hypoxaemia
- * Correct acidosis
- * Reverse atelectasis
- * Rest respiratory muscles

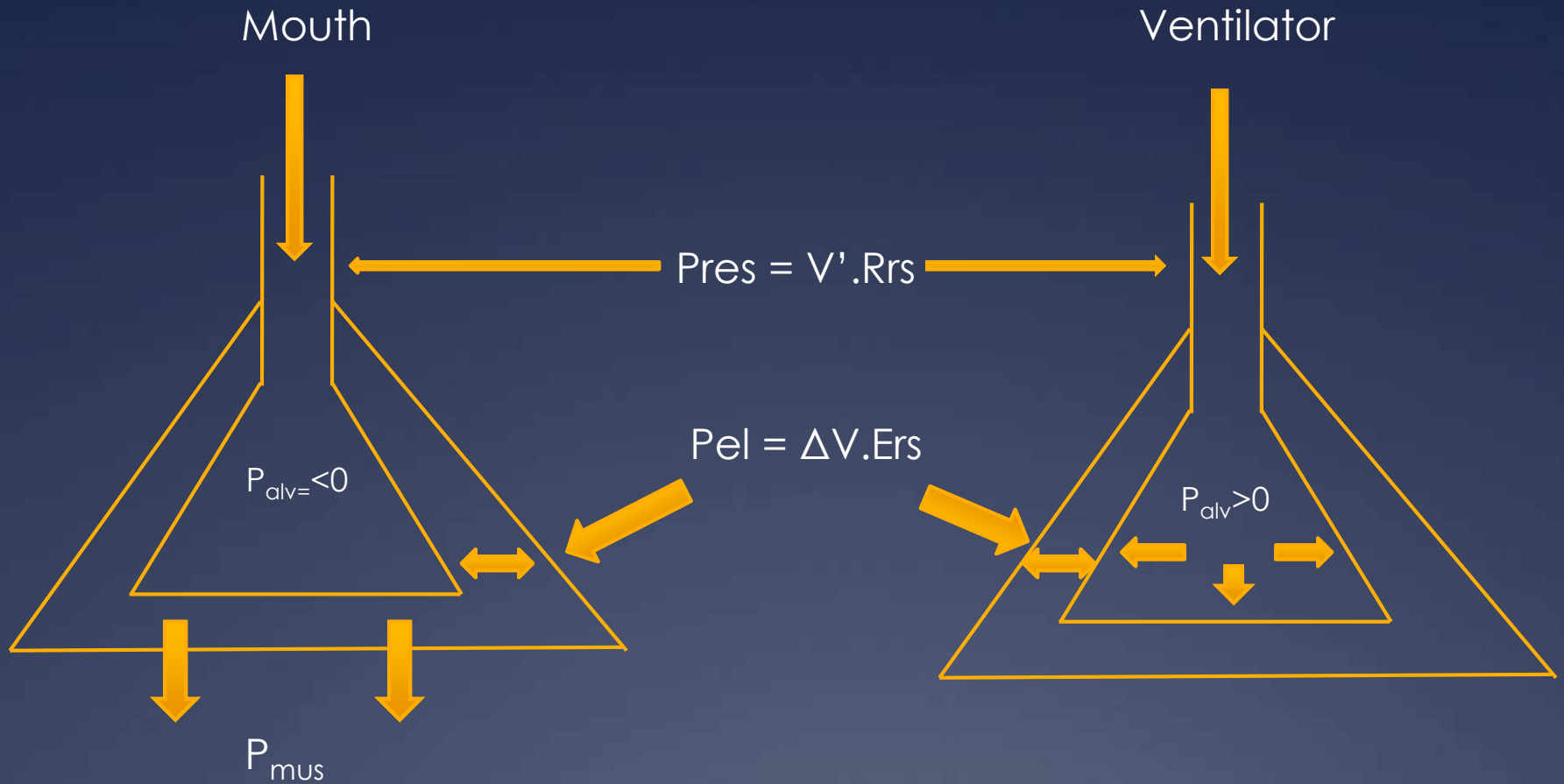
Goals

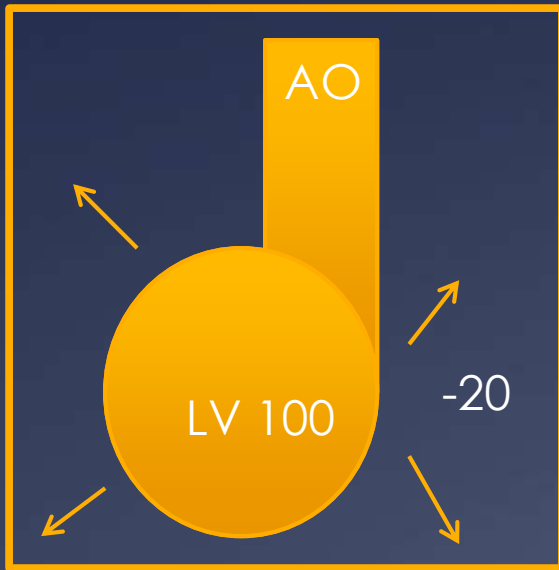
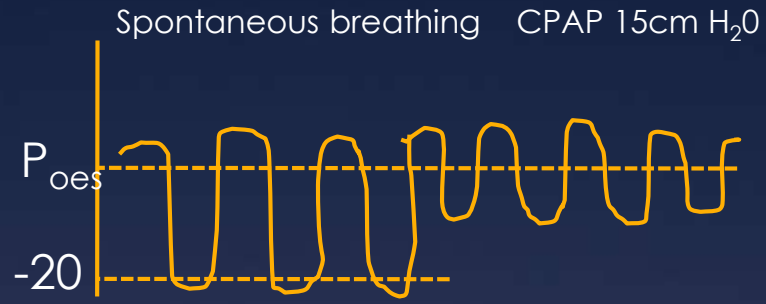
- * Increase life
- * Promote independence
- * Decrease morbidity
- * Decrease hospital admissions
- * Improve quality of life
- * Be cost effective



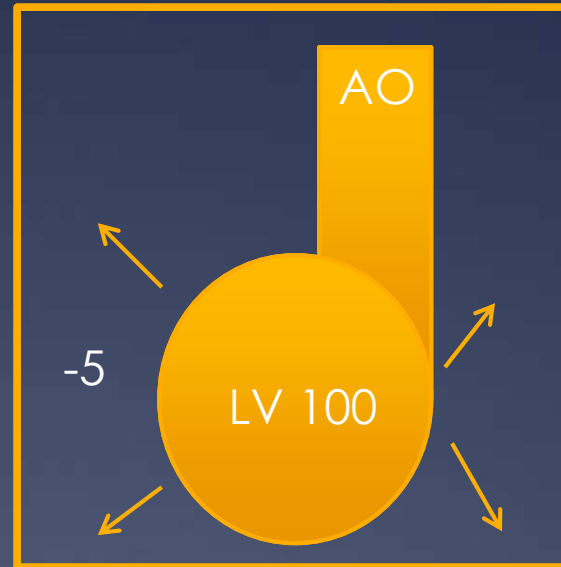
Spontaneous ventilation (or NPVish)

Mechanical ventilation





$$P_{tm} = 100 - (-20) = 120$$



$$P_{tm} = 100 - (-5) = 105$$

What do we do about it

- * Measure respiratory function at time of diagnosis
- * Monitor change in physical parameters and correlate them with the person
- * Inform the patient about the options of respiratory support
- * Work as part of the team to provide support in all aspects of the disease

How do we do it?

Symptoms

- * Epworth Score
- * >9 investigate, >11 abnormal, >15 small children
- * Headache
- * LRTI
- * Weight loss
- * Cough

Muscle weakness

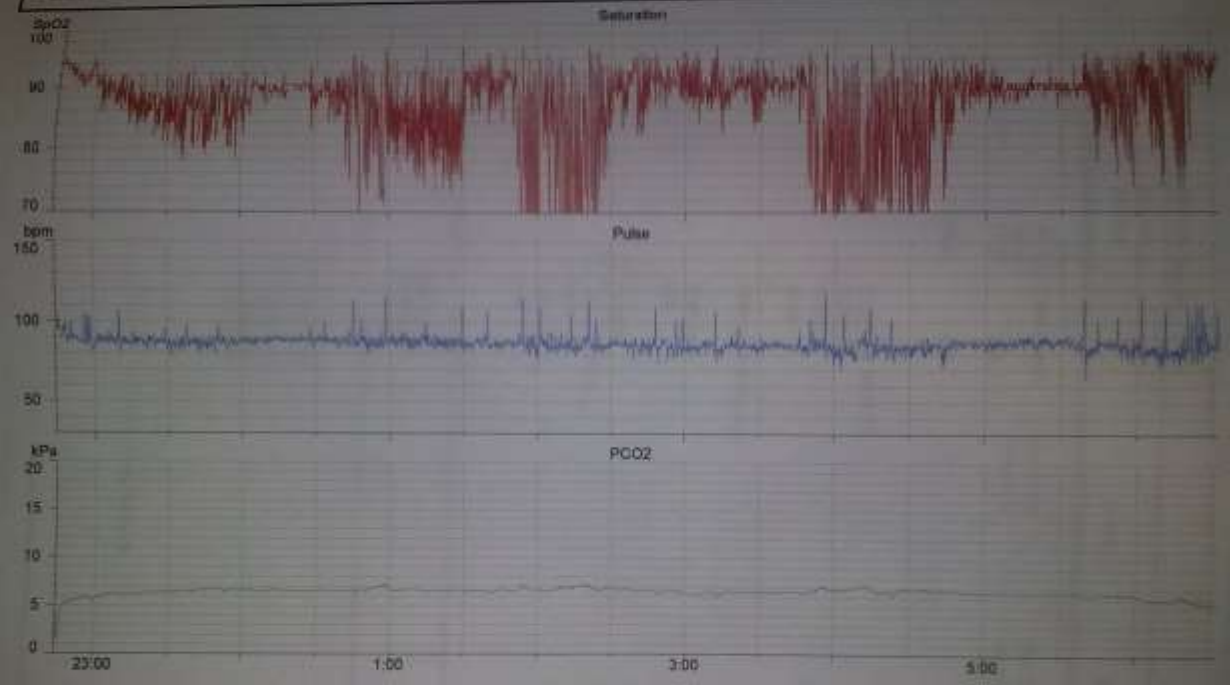
- * FEV1 / FVC <60% expected
- * SNIP < -60 H₂O
- * Poor cough
- * Decreased voice
- * Orthopnoea
- * Fluoroscopy diaphragm
- * Bulbar problems affect measurement

How do we do it?



Enter Number
Date of Birth
Patient Name

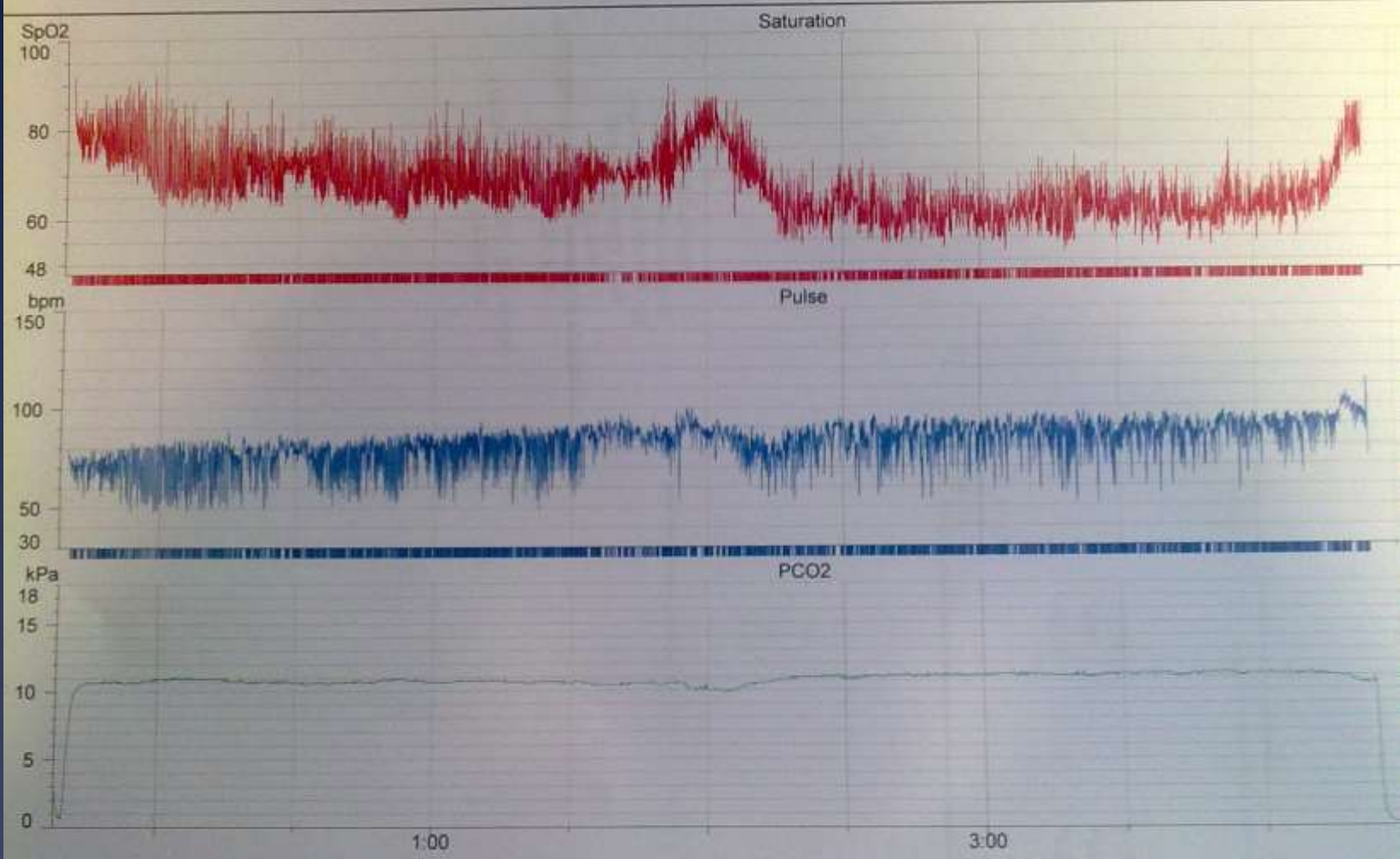
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Events

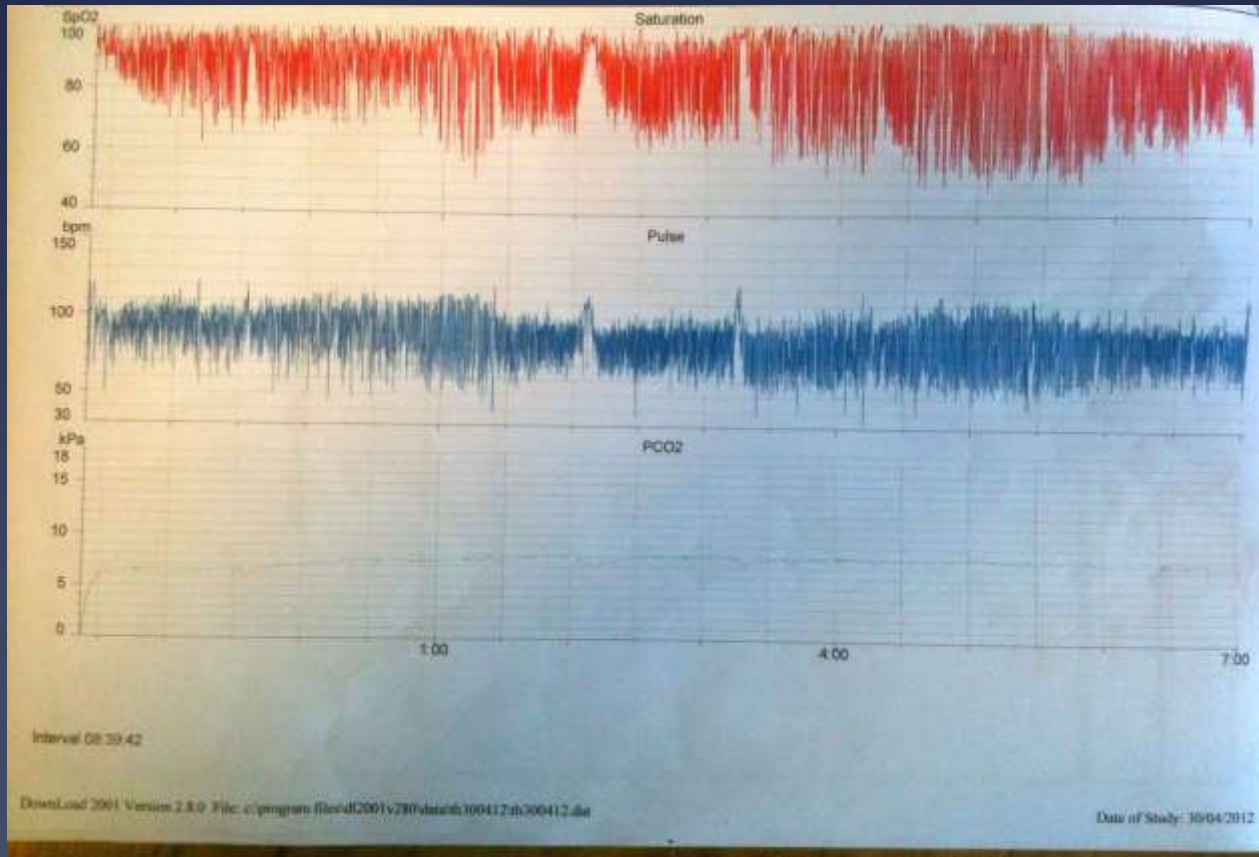
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Date of Birth:
 Patient Name:

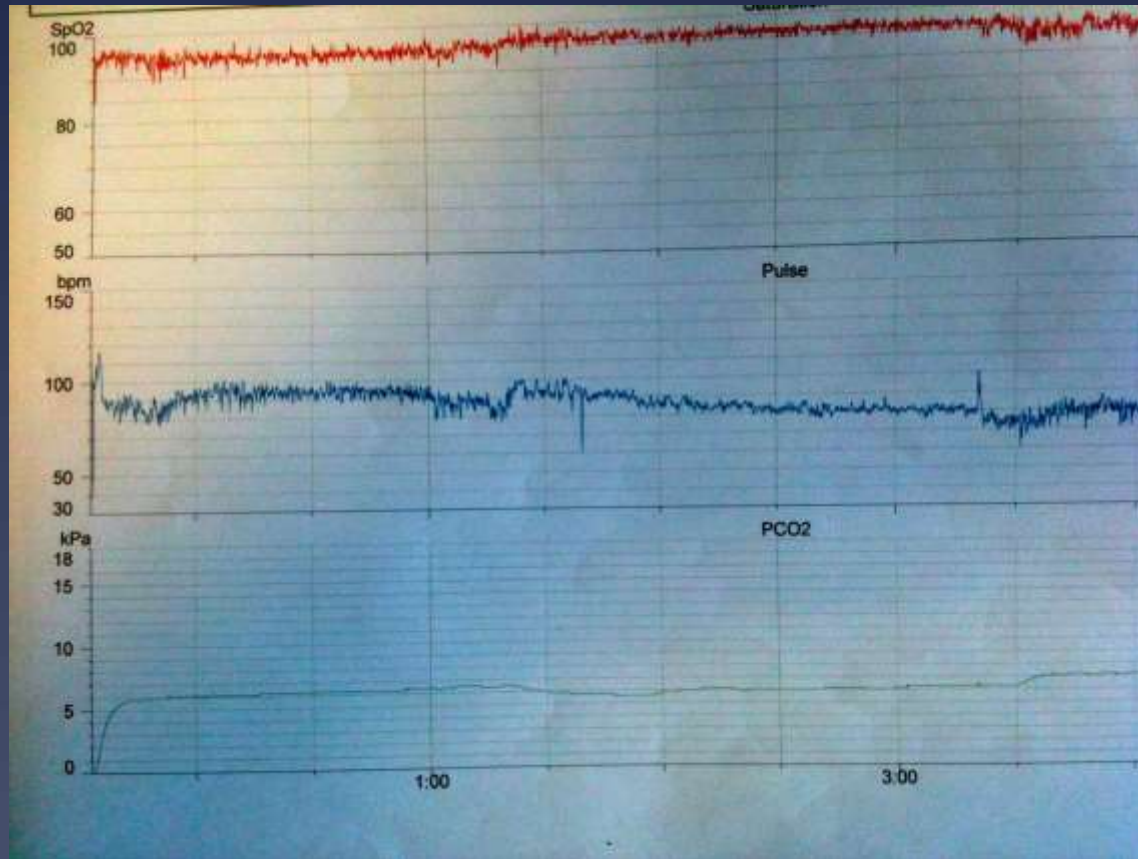


Interval 05:27:15

Before



After



How is it done?

NON INVASIVE

- Nocturnal to ~16h day
- Bulbar function
- Facemask
- Nasal mask / pillows
- Mouthpiece
- Bilevel turbine with leak from CO₂ elimination

INVASIVE (trach)

- >16h day
- Poor bulbar function
- Uncuffed trachey
- Complex ventilators pressure control to allow for leak
- Prolonged insp time for speech

NIV

- * Ventilates predominantly upper lobes / zones
- * Does prevent atelectasis
- * Need assisted cough
- * Efficiency of ventilation OK
- * Nasal bridge breakdown
- * Cumbersome / cosmetic issues
- * Speech takes time
- * Frog breathing, Sipping from ventilator allow increased periods off vent

Invasive

- * Ventilate all lobes
- * PEEP to prevent atelectasis may not be required
- * Allows access to airway
- * Speech well maintained
- * Can alternate cuffed and uncuffed
- * Carer demands greater
- * Costs perceived as greater

Assisted cough

You are going to see a lot more of these..

- * Rapid insufflation with high pressures
- * Negative pressure abruptly
- * Moves secretions
- * “it was like having my lungs pulled out through my throat...”
- * Need to get secretion out of oropharynx too

Other models are available..

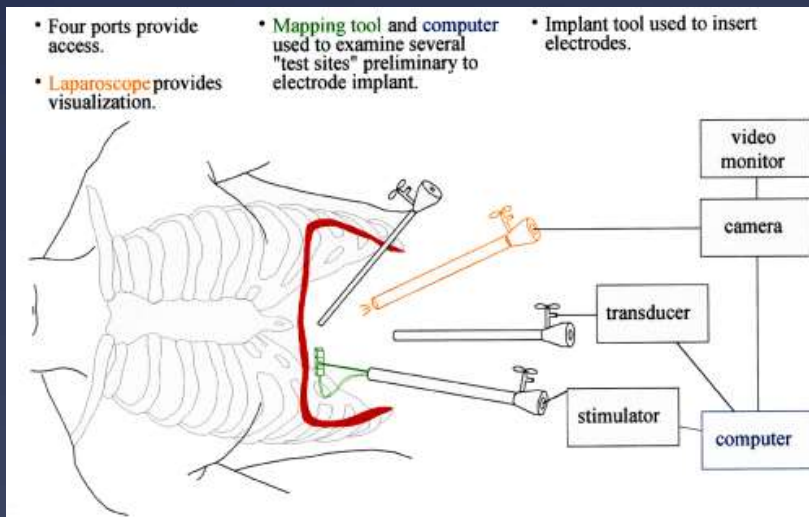


Diaphragmatic pacing

* Works in quadraplegic patients

* Trials beginning in ALS/MND

* May delay the need for ventilation in progressive disease



What is weaning

Weaning is...

- * Spontaneous breathing
- * Discontinuation of mechanical ventilation and the removal of an artificial airway
- * Weaning begins at the time of the first spontaneous breathing trial (SBT)
- * Difficult weaning > 3 SBT or >7 days after first SBT
- * Prolonged mechanical ventilation >21 days with more than 6 hrs mechanical ventilation / day

When to wean?

- * Recovered from illness
 - * Adequate gas exchange
 - * Appropriate neuromuscular function
 - * Stable CV function
-
- * Weaning may represent 40% of ventilated time
 - * Start to wean as soon as the ETT goes in

Who decides when someone is ready?

- * Daily screening / daily interruption of sedation
- * Protocol screening and subsequent SBT not by doctors (Ely 1996)
- * Generally aim to be on the minimum support necessary
- * Weaning may be entering a new era (Metha et al JAMA 2012)

How do you assess if someone is ready to wean?

Objective

- * $P_aO_2/FiO_2 > 150-200$
- * PEEP 5-8 cm H₂O
- * $FiO_2 < 0.5$
- * pH > 7.25
- * RR < 30 – 38 BPM
- * Vt 4-6 ml/kg
- * RSBI (RR/Vt) 60-105

Subjective

- * Haemodynamic stability
- * Absence of myocardial ischaemia
- * Minimal vasopressors CV instability
- * Improving CXR
- * Adequate muscle strength

Spontaneous breathing trial

Dip toe in water

- * Pass SBT 60 – 80% chance of extubation
- * T-piece
- * CPAP 5
- * PS 7
- * 30 60 or 120 minutes

Signs of failure

- * $SpO_2 < 90\%$
- * $PaO_2 < 6-8 \text{ Kpa}$
- * $pH < 7.32$
- * Increase in $PaCO_2$ 1.5 Kpa
- * $RR > 30$, Increased by $> 50\%$
- * CV instability
- * Depressed deteriorating GCS
- * Sweating discomfort

Consequences of delay

Delayed extubation

- * Increased VAP, airway trauma, ICU stay

Failed extubation / reintubation

- * Failed reintubation
- * 8x increase in nosocomial pneumonia
- * 6-12x increase in mortality

How to become a weaner king...

- * Minimum support required right from start
- * Look to reduce support all day every day
- * But don't reduce at night
- * Look to minimise sedation
- * Have a plan – unit protocol or bespoke
- * Make it someone's responsibility

- * 1994 Frequent LRTI, Headaches, day time sleepiness, poor appetite
- * NIV secretions / plugging
- * 1996 Tracheostomy
- * Initially the tracheotomy was quite uncomfortable and difficult to breathe with, which was scary.
- * However, after a few months' recovery and adjustment I suddenly had a new lease for life. I had more energy, it was easier to talk, my appetite improved dramatically, more importantly secretions could be easily suctioned from my lungs through the tracheotomy, significantly reducing chest infections.
- * It definitely was the correct decision as it has allowed me to survive with a good quality of life for much longer.

A Life worth living

- * Holidays / air travel
- * Concerts
- * Independent living
- * University
- * Aiming for 4th and 5th decades
- * www.alifeworthlivingfilm.com

A life worth living...

- * Patients should not be denied access to healthcare
- * Quality and quantity of life are unknown
- * Post op care should focus on the elements of disability as much as physiological and operative concerns