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Noninvasive and invasive ventilation in Obstructive Pulmonary Diseases

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Noninvasive and invasive ventilation in Obstructive Pulmonary Diseases

Pathopysiology

Non-Invasive Ventilation(NIV)

Mechanical Invasive Ventilation

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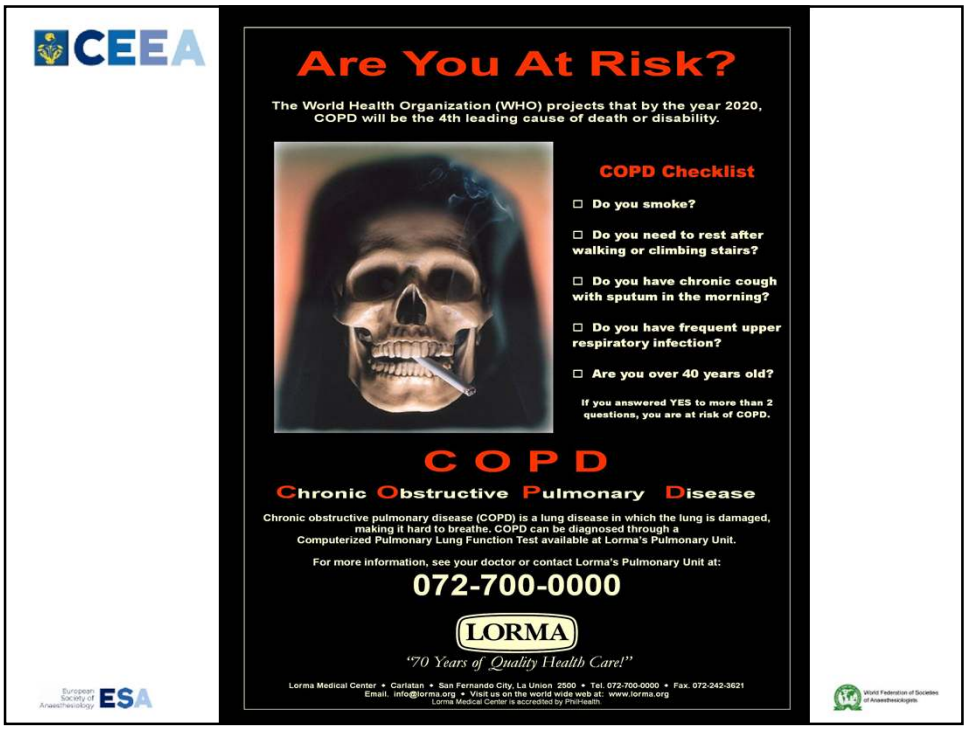
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Are You At Risk?
The World Health Organization (WHO) projects that by the year 2020, COPD will be the 4th leading cause of death or disability.
COPD Checklist
☐ Do you smoke?
☐ Do you need to rest after walking or climbing stairs?
☐ Do you have chronic cough with sputum in the morning?
☐ Do you have frequent upper respiratory infection?
☐ Are you over 40 years old?
If you answered YES to more than 2 questions, you are at risk of COPD.
C O P D
Chronic Obstructive Pulmonary Disease
Chronic obstructive pulmonary disease (COPD) is a lung disease in which the lung is damaged, making it hard to breathe. COPD can be diagnosed through a Computerized Pulmonary Lung Function Test available at Lorma's Pulmonary Unit.
For more information, see your doctor or contact Lorma's Pulmonary Unit at:
072-700-0000
LORMA
"70 Years of Quality Health Care!"
Lorma Medical Center • Carlatan • San Fernando City, La Union 2500 • Tel. 072-700-0000 • Fax. 072-242-3621
Email. info@lorma.org • Visit us on the world wide web at: www.lorma.org
Lorma Medical Center is accredited by PhilHealth
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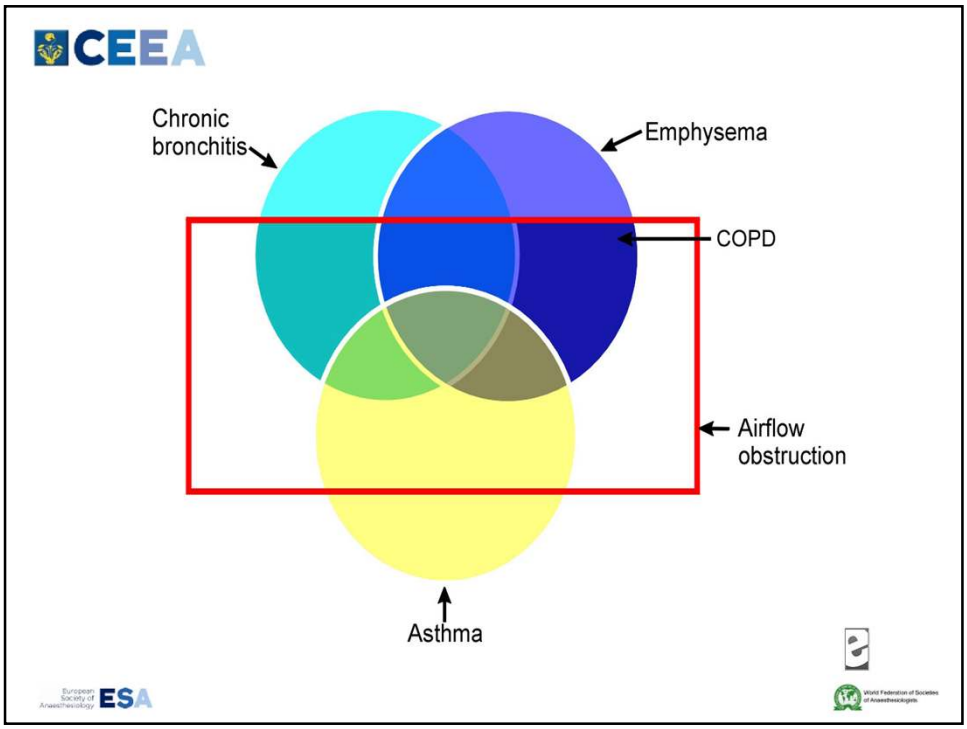
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Chronic bronchitis
Emphysema
COPD
Airflow obstruction
Asthma
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VOLUMETRIA12
X : -90.0
Y : 0.0
Z : 180.0
1935.470cm3
X : -90.0
Y : 0.0
Z : 180.0
0.245cm3
VOLUMETRIA12


Y : 0.0
Z : 180.0
1105.894cm3
Y : 0.0
Z : 180.0
4943.848cm3

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Auto-PEEP/ Intrinsic PEEP/Air trapping/Dynamic Hyperinflation

What is Auto-PEEP/DHI?

- Normally, at end expiration, the lung volume is equal to the FRC
- When PEEPi occurs, the lung volume at end expiration is greater then the FRC

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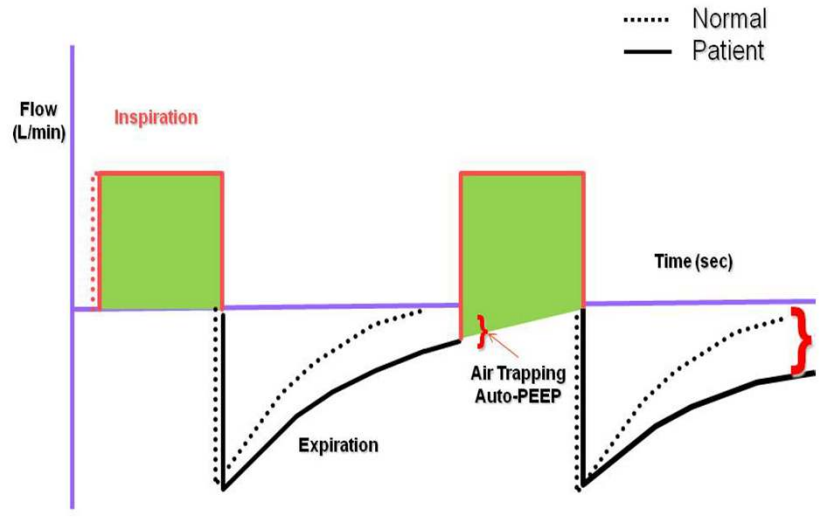
Air Trapping



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Clinical consequences of DHI

Table 2. IMPORTANT CLINICAL CONSEQUENCES OF iPEEP AND DHI

Respiratory effects
- ↓ effectiveness of respiratory muscles
- Ineffective triggering of ventilator
- ↑ workload and respiratory muscle fatigue
- ↑ intrapulmonary pressures and risk of barotrauma

Cardiovascular side-effects
- ↓ venous return
- ↓ right and left ventricular preload
- ↑ right ventricular afterload
- ↓ left ventricular compliance
- electromechanical dissociation

Incorrect physiological measurements
- underestimates airways
- overestimates compliance

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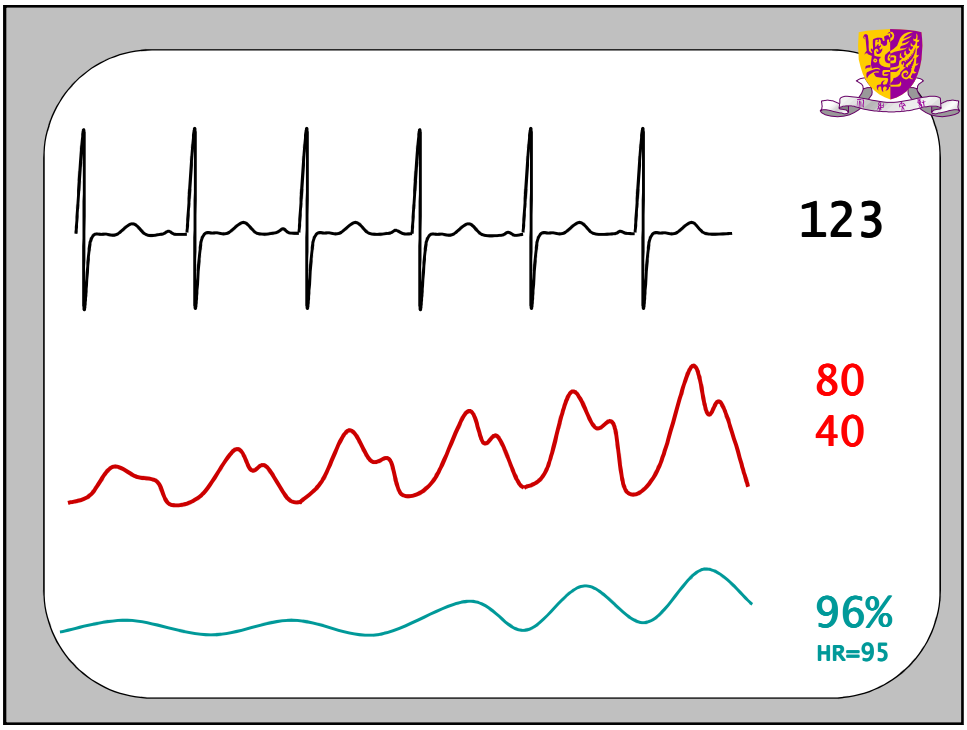

COPD and cardiovascular mortality

Forced expiratory volume in one second (FEV_1):
-second to smoking
-above blood pressure and cholesterol

as a predictor of all-cause and cardiovascular mortality !!!

COPD-increased risk of cardiovascular disease and death:pathogenetic models

Inflammation model

Pulmonary Hypertension model

Lung hyperinflation model

Shared genetics model

The Pulmonary Hypertension Model

Factors affecting PH in COPD	Impact on pulmonary vessels
Airflow limitation	Pressure swings
Emphysema	Reduction of vascular bed
Alveolar hypoxia	Vasoconstriction/remodeling
Hypercapnic acidosis	Vasoconstriction
Polycythaemia	Hyperviscosity
Lung/systemic inflammation	Remodelling, including fibrosis

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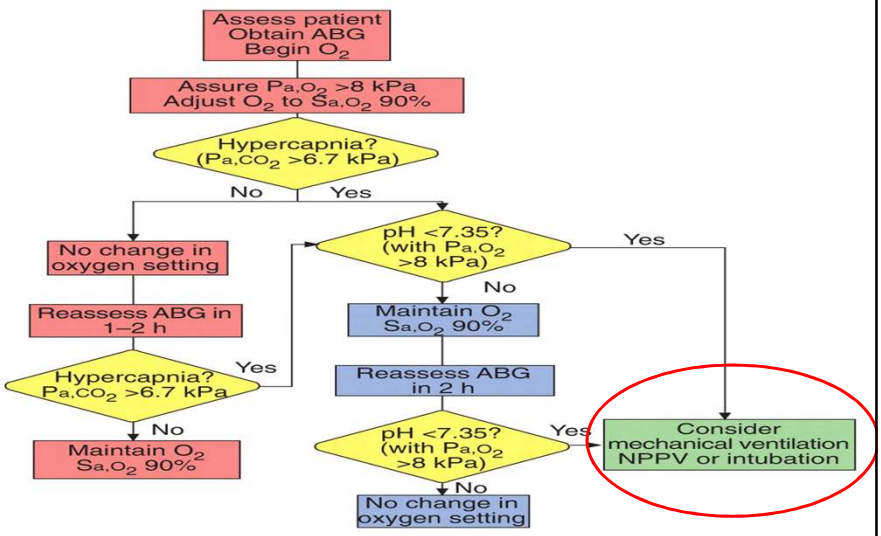
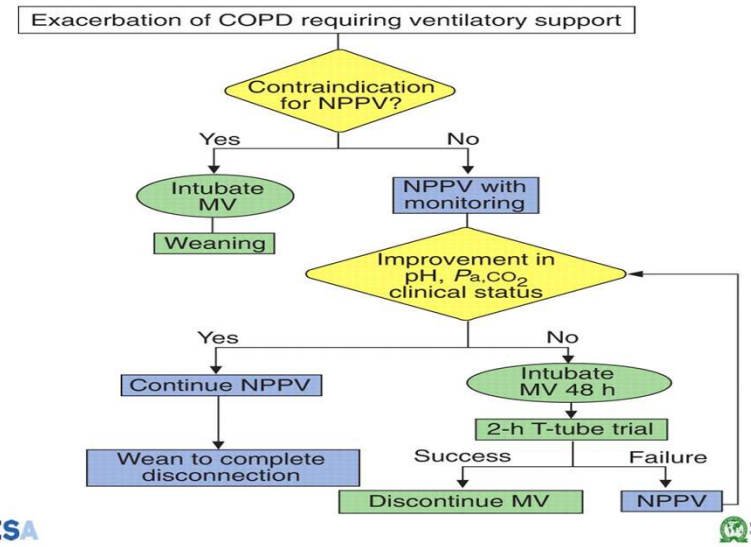
European Respiratory Society(ERS) Guidelines in COPD(2010)



ERS Guidelines in COPD



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Non-invasive ventilation in chronic obstructive pulmonary disease: British National Guidelines 2008

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British National Guidelines 2008 NIV: Inclusion criteria

COPD in whom a respiratory acidosis persists despite maximum standard medical treatment, which includes:

- controlled oxygen to maintain SaO2 88–92%
- nebulised salbutamol 2.5–5 mg
- nebulised ipratroprium 500 µg
- prednisolone 30 mg
- antibiotic agent (when indicated), ETC.

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British National Guidelines 2008
NIV: Exclusion criteria

Life-threatening hypoxaemia
Severe co-morbidity
Confusion/agitation/severe cognitive impairment
Facial burns/trauma/recent facial or upper airway surgery
Vomiting
Fixed upper airway obstruction
Undrained pneumothorax
Upper gastrointestinal surgery
Inability to protect the airway
Copious respiratory secretions
Haemodynamically unstable requiring inotropes/pressors *(unless in a critical care unit)*
Patient moribund
Bowel obstruction

British National Guidelines 2008
NIV: Set-up

The patient in a sitting or semi-recumbent position

• A full-face mask should be used for the first 24 hours, followed by switching to a nasal mask if preferred by the patient (C)

• An initial inspiratory positive airway pressure (IPAP) of 10 cm H2O and expiratory positive airway pressure (EPAP) of 4–5 cm H2O should be used (A)

• IPAP should be increased by 2–5 cm increments at a rate of approximately 5 cm H2O every 10 minutes, with a usual pressure target of 20 cm H2O or until a therapeutic response is achieved or patient tolerability has been reached (A)

British National Guidelines 2008
NIV: Set-up

- Oxygen, when required, should be entrained into the circuit and the flow adjusted to achieve the target saturation, usually 88–92%.19 (B)
- Bronchodilators, although preferably administered off NIV, should as necessary be entrained between the expiration port and face mask. (Delivery of both oxygen and nebulised solutions is affected by NIV pressure settings (A)
- If a nasogastric tube is in place, a fine bore tube is preferred to minimise mask leakage

British National Guidelines 2008
NIV: Monitoring

Clinical observations including:
- respiratory rate, heart rate
- level of consciousness, patient comfort
- chest wall movement, ventilator synchrony, accessory muscle use

Frequent clinical monitoring of acutely ill patients:
- every 15 minutes in the first hour
- every 30 minutes in the 1- to 4-hour period
- hourly in the 4- to 12-hour period

British National Guidelines 2008
NIV: Monitoring

Baseline observations:
- arterial blood gas (ABG)
- respiratory rate
- heart rate

Continuous pulse oximetry and electrocardiogram (ECG)

Repeat ABGs:
- after 1 hour of NIV therapy and 1 hour after every subsequent change in settings
- after 4 hours, or earlier in patients who are not improving clinically

British National Guidelines 2008
NIV: Monitoring

Patient comfort and enhanced compliance are key factors in determining outcome(A) !!!

- Synchrony of ventilation should be checked frequently
- A clinical assessment of mask fit to include skin condition and degree of leak should be performed at the same time.

British National Guidelines 2008
NIV: Weaning

-Initially weaning should be during the day

-Extended periods off the ventilator for meals, physiotherapy, nebulised therapy etc.

-After successfully weaning during the day, many patients will require an additional night on NIV (C)

-The weaning strategy should be documented in the medical and nursing records (C)

British National Guidelines 2008
NIV: Weaning

The following is recommended (A):

- **continue NIV for 16 hours on day 2**
- **continue NIV for 12 hours on day 3 including 6–8 hours overnight use**
- **discontinue NIV on day 4, unless continuation is clinically indicated.**

Note that some patients may:

- *show at an earlier stage that they no longer require NIV and self-wean*
- *improve rapidly, prompting a clinical decision to wean early*
- *require long-term nocturnal support, indicated following assessment by the respiratory team.*

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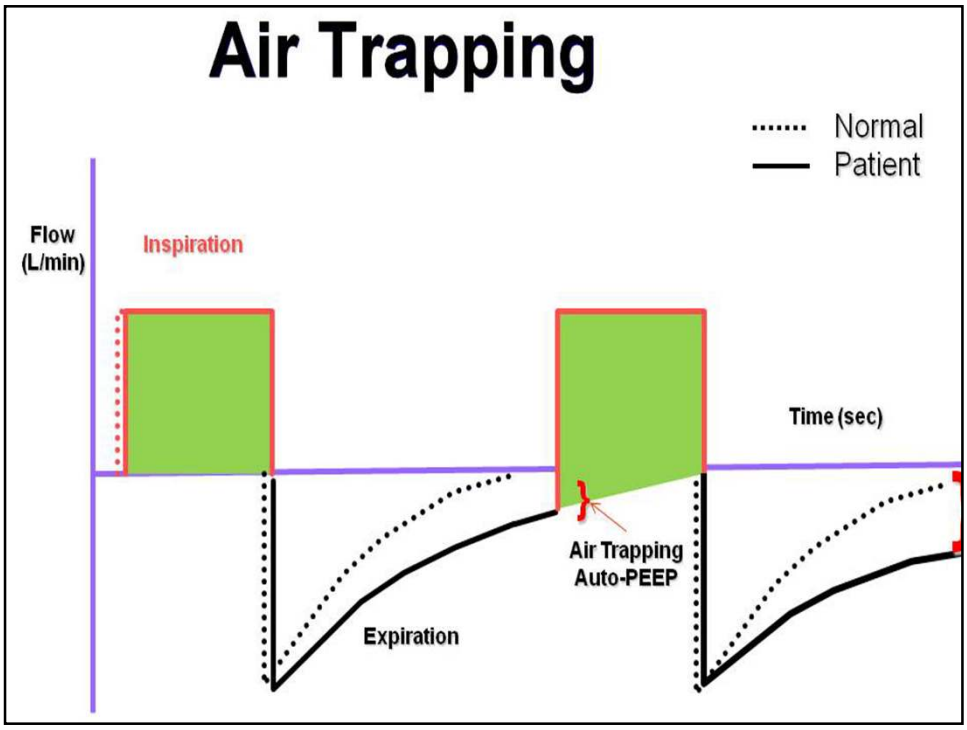

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Ventilation in COPD and Asthma

Goals:

1. Diminish dynamic hyperinflation
2. Diminish work of breathing
3. Controlled hypoventilation (permissive hypercapnia)

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Which mode of ventilation ?

-Volume controlled ?

-Pressure controlled ?

In terms of barotrauma and cardiovascular effects it is alveolar pressure that is important, not airway pressure !

Which mode of ventilation ?

Volume control

– Lung compliance relatively normal =alveolar pressure unlikely to be high.

- Airway pressure possible high- but does not matter.

Pressure control

– Tidal volume will be low because of high resistance in airways

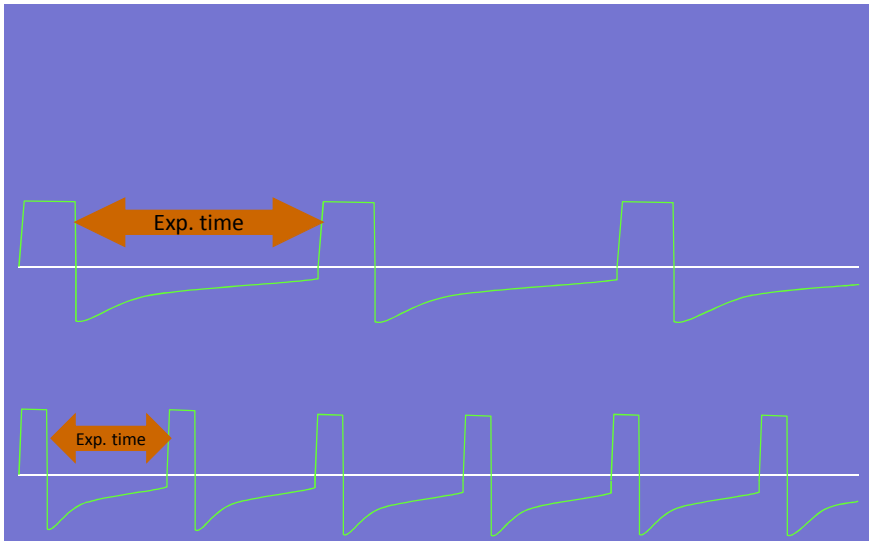
- If pressure set very high: risk of barotrauma and volutrauma when asthma “breaks”.

Assist control-options

Longer inspiratory time ?
- Improved oxygenation
  - Higher mean airway pressure
  - Re-distribution
- Lower peak airway pressure
  - More time available to deliver set tidal volume

Shorter inspiratory time ?
- Longer expiratory time
- Less risk of gas trapping
- Less effect on cardiovascular system

Assist control-options: Respiratory Rate



Assist control-options

Inspiratory pause ?

- Lungs held in inspiration
- More even distribution of ventilation
- Improves oxygenation
- Additional to set inspiratory time
- BUT reduces the expiratory time !

Ventilation goals1: Diminish DHI

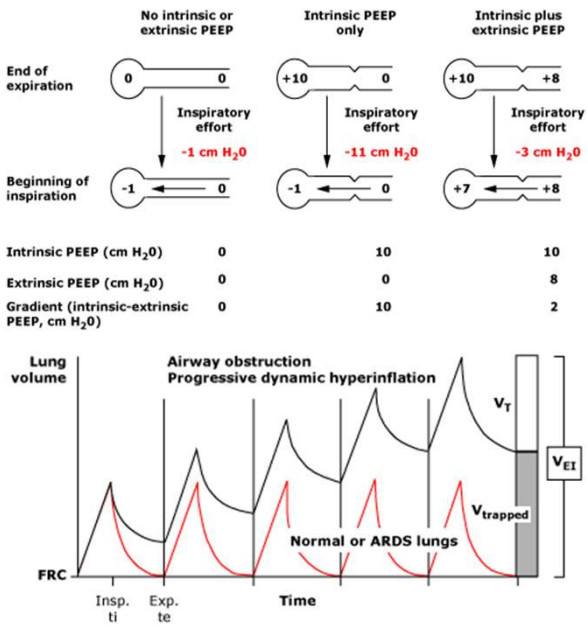
How?

- Low Vt (6-8 cc/kg)
- Low RR (8-10 b/min)
- Maximize expiratory time(low I:E ratio)

Ventilation goals 2: Diminish work of breathing

To PEEP or not to PEEP ?

Vent Settings Asthma



Ventilation goals 2: Diminish work of breathing

How:

- Add PEEP (about 85% of PEEPi)
- Applicable in COPD and Asthma.

3. Controlled hypercapnia

Why?

- Limit high airway pressures and thus diminish the risk of complications

Controlled hypercapnia

How?

- Control the ventilation to keep adequate pressures up to a PH > 7.20 and/or a PaCO2 of 80 mmHg

Controlled hypercapnia

CI:

- Head pathologies
- Severe HTN
- Severe metabolic acidosis
- Hypovolemia
- Severe refractory hypoxia
- Severe pulmonary HTN
- Coronary disease

Vent Settings Asthma

- Respiratory rate 8- 10 breaths/min
  (allows more time for exhalation)
- Low I:E ratio(>1:2)
- Tidal volume less than 8 mL/kg
- Inspiratory flow of 80 to 100 L/min
- Extrinsic postive end-expiratory pressure *less than* 80 percent of the intrinsic PEEP
- Continue inhaled medications and steroids

Cursul de Ghiduri si Protocoale in ATI si Medicina de Urgenta, editia X Timisoara, 4-6 Oct 2012

- 25 speakeri internationali
- Personalitati marcante: President WFSA, President ESA, etc
- Acces gratuit la lucrarile Intalnirii Societatii Europene de *Computing and Technology* in ATI!
- Volumul intalnirii+Pachet cu 3 Manuale de Ventilatie Mecanica Non si Invaziva !
- Acces pe site la inregistrarea video/audio a prezentarilor
- Program social grozav !

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