

TRATTARE L'INSUFFICIENZA RESPIRATORIA CON LA VENTILAZIONE NON INVASIVA

Tommaso Fossali

U.O. Anestesia e Rianimazione



Ospedale Luigi Sacco
POLO UNIVERSITARIO

Sistema Socio Sanitario



Regione
Lombardia

ASST Fatebenefratelli Sacco

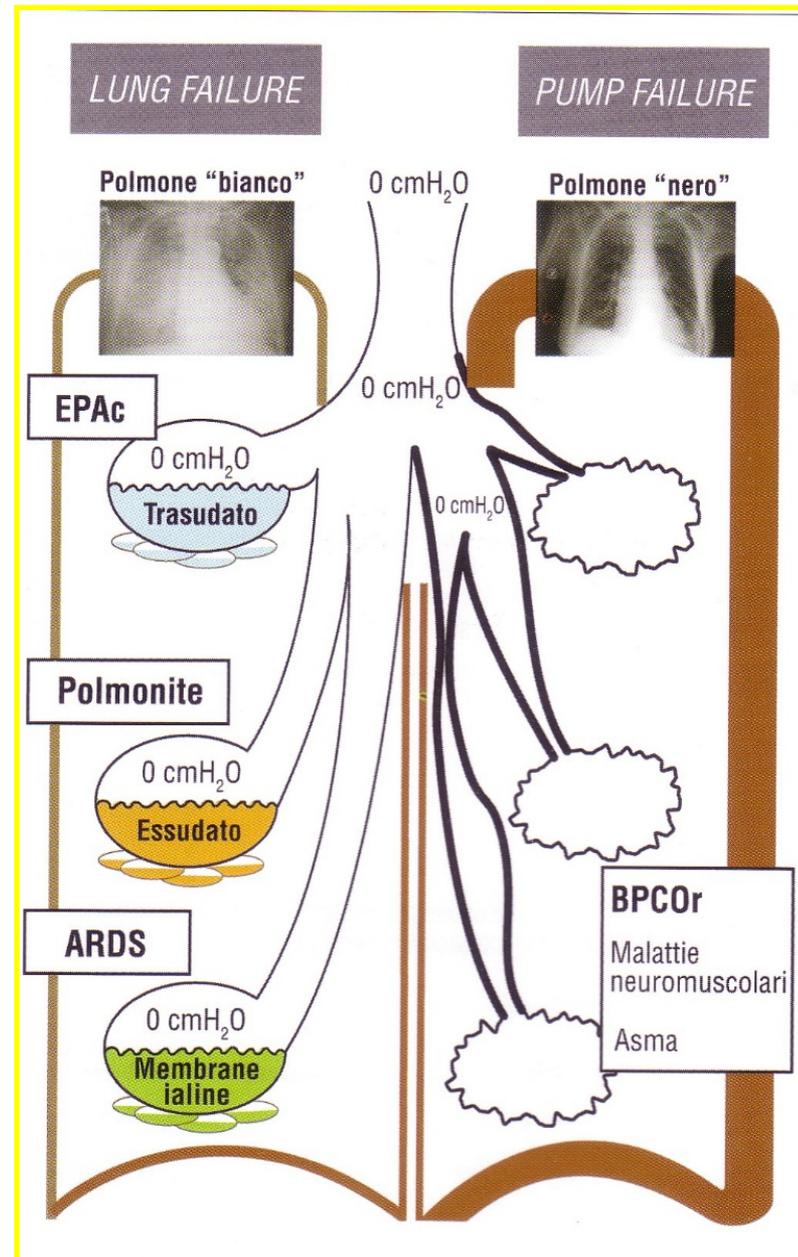
INSUFFICIENZA RESPIRATORIA

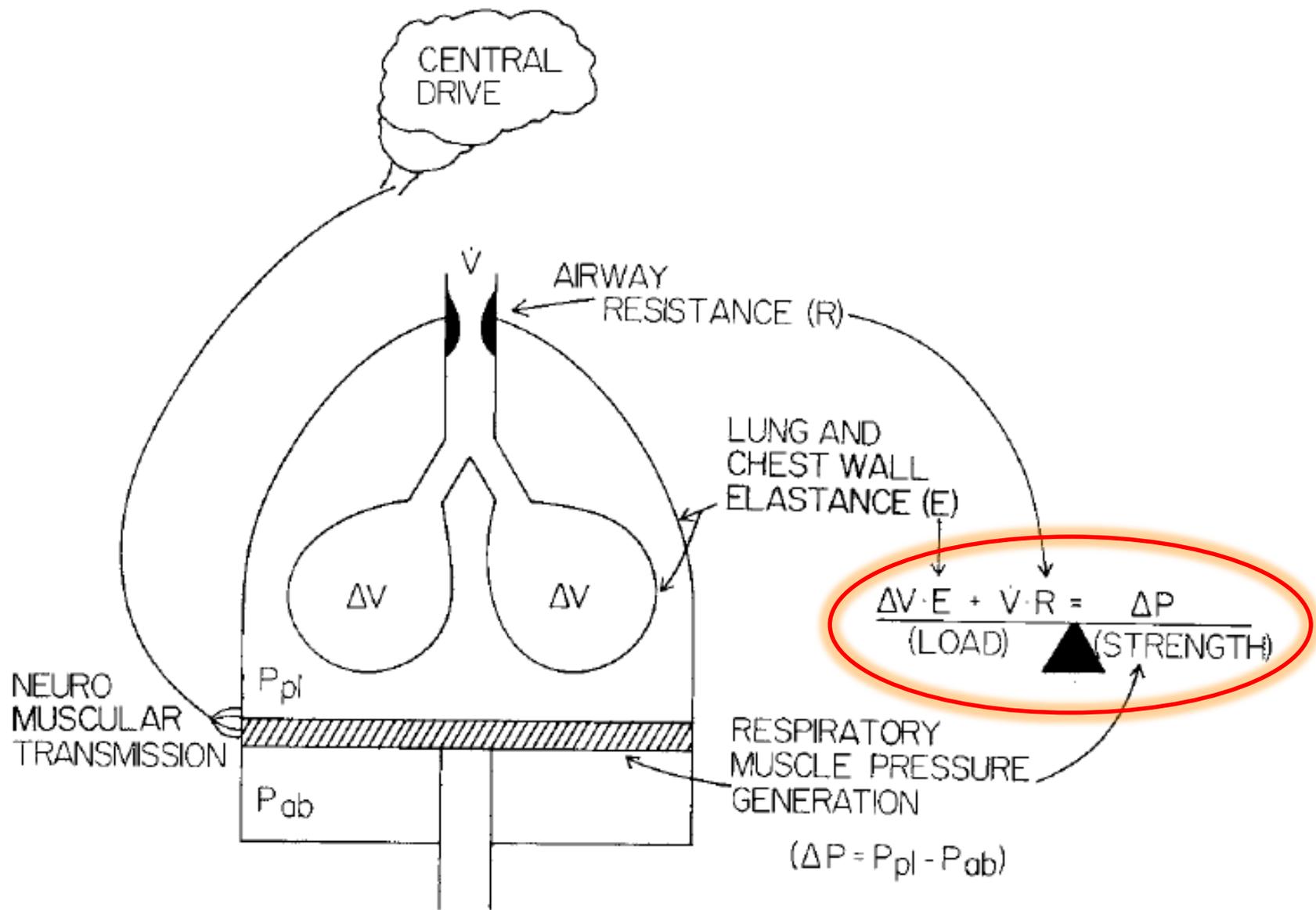
LUNG FAILURE
ipossiemia

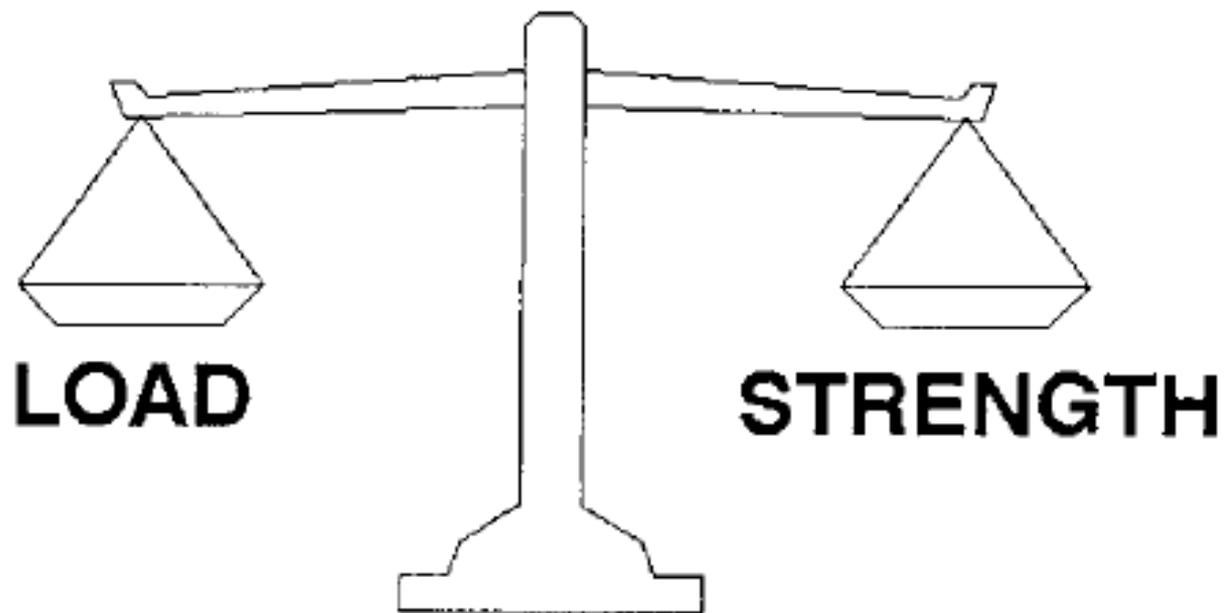


PUMP FAILURE
Ipossiemia+ipercapnia

NIV

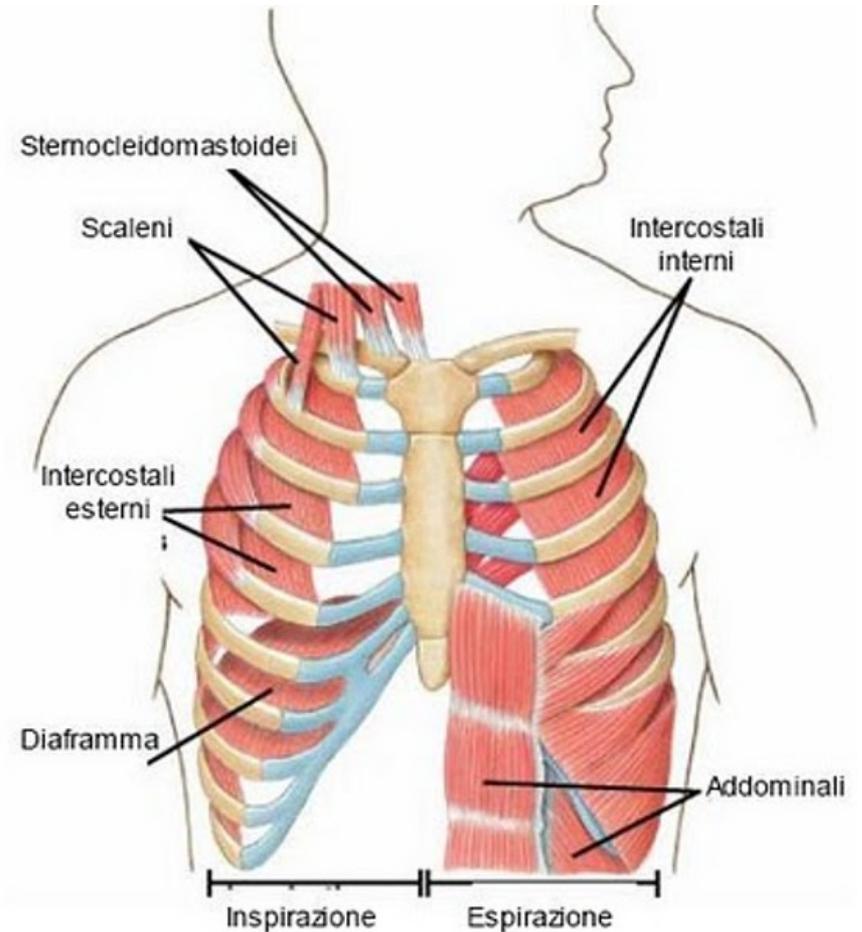






FATICA RESPIRATORIA

IL LAVORO ECCESSIVO
PORTA ALLA FATICA



FATICA RESPIRATORIA

VALUTAZIONE CLINICA

- ➡ cianosi, alitamento pinne nasali
- ➡ FR >30 o <12 , incapacità a completare le frasi
- ➡ ritmo irregolare, respiri superficiali, asimmetrici
- ➡ utilizzo mm. accessoria, discinesia toraco-addominale
- ➡ segni di ostruzione alte vie: stridor e tirage

VENTILAZIONE ALVEOLARE

$$V_A = \frac{VCO_2}{PaCO_2} \times 0.863$$

L'aumento della PaCO₂ è indice di ipoventilazione

BPCO riacutizzata ipercapnica

Forme ipercapniche di edema cardiogeno

Non Invasive Ventilation

AMBIENTE – DOVE FARLA?

- Personale esperto – area critica – elevato rapporto inf/pz (1 inf/2 NIV)
- Possibilità di monitoraggio continuo (ECG, PA, SaO₂)
- Possibilità di EGA seriate
- Presenza di ventilatore, circuiti, interfacce

Non Invasive Ventilation

IL PAZIENTE

- Spiega al paziente cosa vuoi fare e perché
- Appoggia la maschera sul volto del paziente per alcuni minuti prima di fissarla
- Rimani con il paziente durante l'adattamento all'interfaccia
- Valuta eventuale sedazione

Non Invasive Ventilation

INTERFACCIA

Maschera nasale

Maschera oro-nasale

Maschera total full-face

Casco o scafandro

Non Invasive Ventilation

INTERFACCIA

~~Maschera nasale~~

Maschera oro-nasale

Maschera total full-face

~~Casco e scafandro~~



Non Invasive Ventilation

INTERFACCIA

Maschera oro-nasale

Maschera total full-face



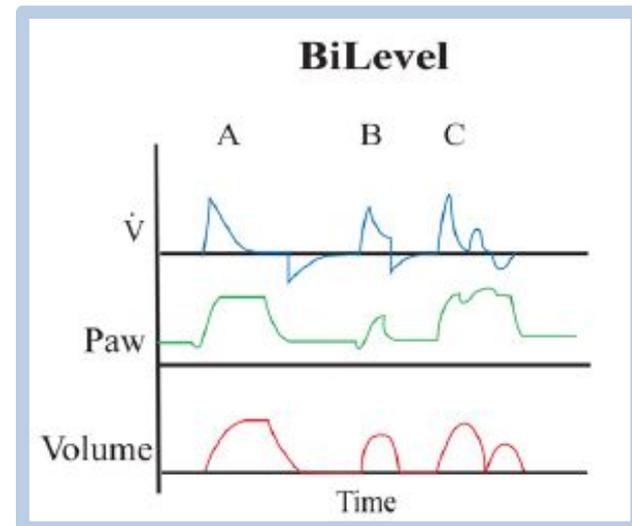
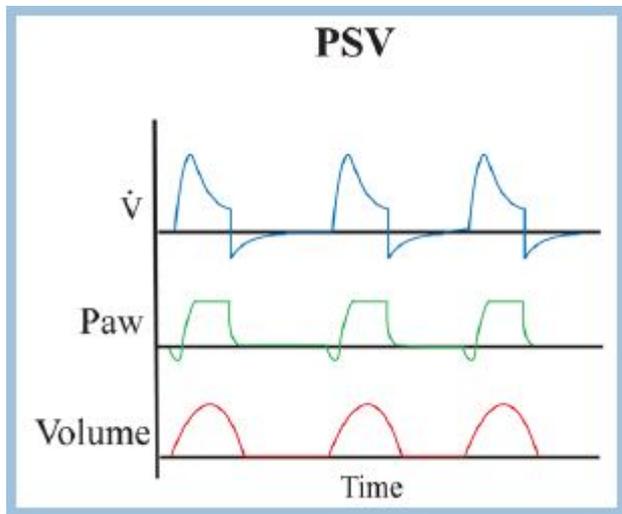
Non Invasive Ventilation

Pressure Support

Forma di assistenza parziale: lo sforzo inspiratorio spontaneo del pz viene sostenuto da un aumento della pressione delle vie aeree al di sopra della PEEP

BiPAP o BiLevel

Due livelli di pressione positiva (EPAP e IPAP)



Non Invasive Ventilation

IL VENTILATORE

Pressure Support

- Trigger inspiratorio
- Trigger espiratorio
- PS
- PEEP
- $F_{I}O_{2}$

Riduce Work Of Breathing (WOB)

Il paziente ha il controllo della sua ventilazione
inizia l'atto respiratorio quando desidera

Non Invasive Ventilation

IL VENTILATORE

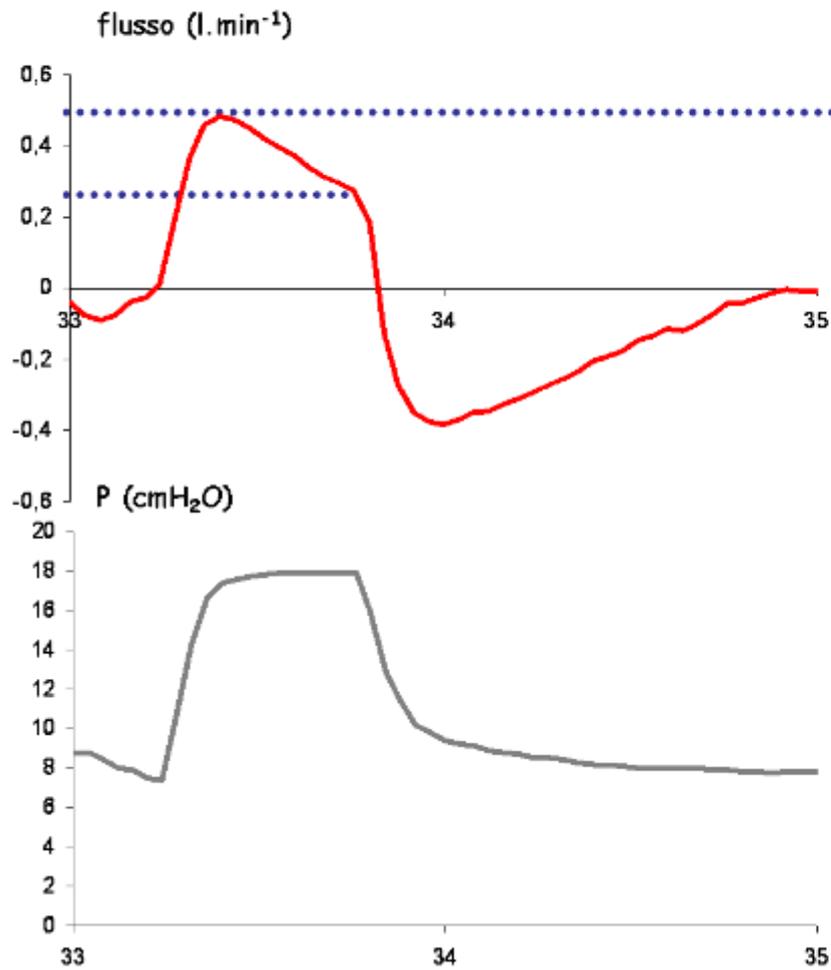
- TRIGGER INSPIRATORIO il pz respira in un circuito chiuso dove il ventilatore eroga un flusso continuo di base (flow-by). La riduzione di flusso o pressione innesca l'atto respiratorio

Non Invasive Ventilation

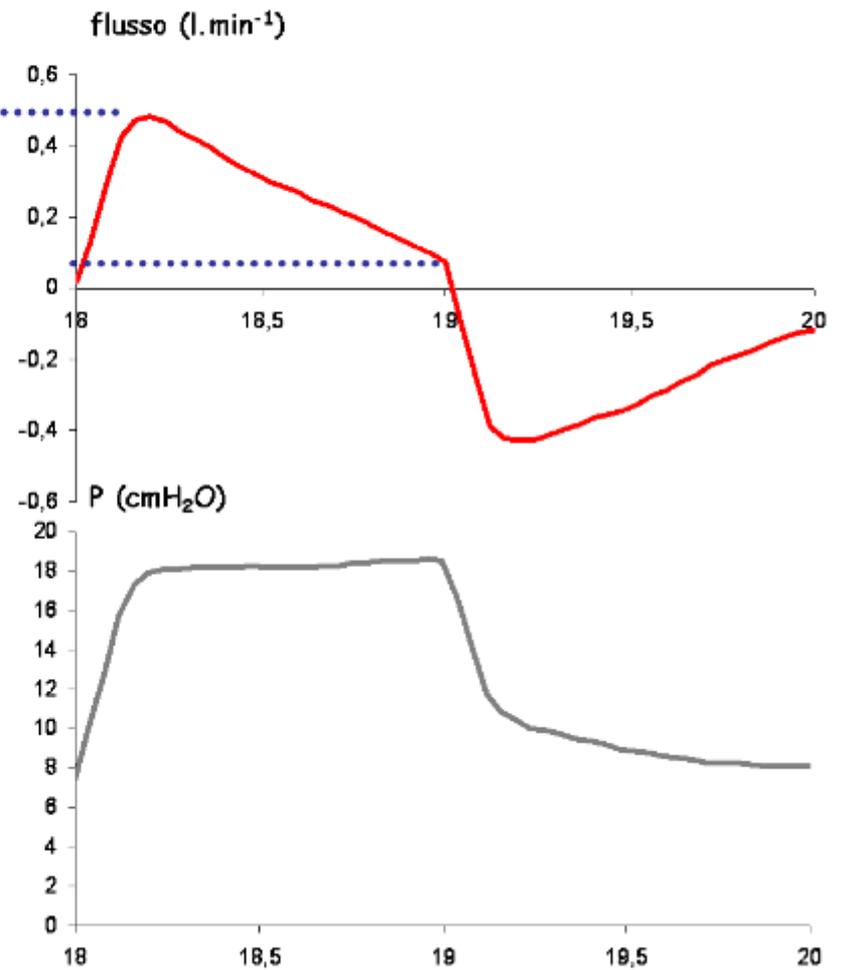
IL VENTILATORE

- TRIGGER ESPIRATORIO durante l'inspirazione il flusso aumenta progressivamente fino a raggiungere un picco. La valvola espiratoria si apre quando il flusso si riduce a una percentuale predefinita del picco inspiratorio

50 %



5 %



CONTROINDICAZIONI NIV

- Arresto respiratorio
- Mancanza protezione vie aeree
- Secrezioni eccessive
- Vomito/ematemesi
- Traumi/ustioni cranio-facciali
- Non collaborazione/Agitazione
- Non aderenza dell'interfaccia
- Recente chirurgia delle alte vie aeree o del tratto gastrointestinale

Table 3 Technical issues: a guide for when NIV is failing

Problem	Cause(s)	Solution (s)
Ventilator cycling independently of patient effort	Inspiratory trigger sensitivity is too high Excessive mask leak	Adjust trigger Reduce mask leak
Ventilator not triggering despite visible patient effort	Excessive mask leak Inspiratory trigger sensitivity too low	Reduce mask leak Adjust trigger For NM patients consider switch to PCV
Inadequate chest expansion despite apparent triggering	Inadequate Tidal volume	Increase IPAP. In NM or chest wall disease consider longer Ti
Chest/abdominal paradox	Upper airway obstruction	Avoid neck flexion Increase EPAP
Premature expiratory effort by patient	Excessive Ti or IPAP	Adjust as necessary

EPAP, expiratory positive airway pressure; IPAP, inspiratory positive airway pressure; NIV, non-invasive ventilation; NM, neuromuscular; PCV, pressure-controlled ventilation.

NIV

- La prima ora è fondamentale per vedere la risposta
- L'assenza di miglioramento di dispnea, EGA, meccanica/frequenza respiratoria suggerisce necessità di intubazione

PH > 7.25

RR < 25

BTS/ICS guideline for the ventilatory management of acute hypercapnic respiratory failure in adults

A Craig Davidson,¹ Stephen Banham,¹ Mark Elliott,² Daniel Kennedy,³ Colin Gelder,⁴ Alastair Glossop,⁵ Alistair Colin Church,⁶ Ben Creagh-Brown,⁷ James William Dodd,^{8,9} Tim Felton,¹⁰ Bernard Foëx,¹¹ Leigh Mansfield,¹² Lynn McDonnell,¹³ Robert Parker,¹⁴ Caroline Marie Patterson,¹⁵ Milind Sovani,¹⁶ Lynn Thomas,¹⁷ BTS Standards of Care Committee Member, British Thoracic Society/Intensive Care Society Acute Hypercapnic Respiratory Failure Guideline Development Group, On behalf of the British Thoracic Society Standards of Care Committee

Indications for NIV

COPD

pH <7.35
pCO₂ >6.5
RR >23

If persisting after bronchodilators and controlled oxygen therapy

Neuromuscular disease

Respiratory illness with RR > 20 if usual VC <1L even if pCO₂ < 6.5

Or

pH < 7.35 and pCO₂ > 6.5

Obesity

pH <7.35, pCO₂ >6.5, RR >23

Or

Daytime pCO₂ > 6.0 and somnolent

Contraindications for NIV

Absolute

Severe facial deformity
Facial burns
Fixed upper airway obstruction

Relative

pH <7.15
(pH <7.25 and additional adverse feature)
GCS <8

Confusion/agitation
Cognitive impairment (warrants enhanced observation)

Indications for referral to ICU

AHRF with impending respiratory arrest

NIV failing to augment chest wall movement or reduce pCO₂

Inability to maintain SaO₂ > 85-88% on NIV

Need for IV sedation or adverse features indicating need for closer monitoring and/or possible difficult intubation as in OHS, DMD.

NIV Not indicated

Asthma/Pneumonia

Refer to ICU for consideration IMV if increasing respiratory rate/distress or
pH <7.35 and pCO₂ >6.5

NIV SETUP

Mask

Full face mask (or own if home user of NIV)

Initial Pressure settings

EPAP: 3 (or higher if OSA known/expected)

IPAP in COPD/OHS/KS 15 (20 if pH <7.25)

Up titrate IPAP over 10-30 mins to IPAP 20-30 to achieve adequate augmentation of chest/abdo movement and slow RR

IPAP should not exceed 30 or EPAP 8* without expert review

IPAP in NM 10 (or 5 above usual setting)

Backup rate

Backup Rate of 16-20. Set appropriate inspiratory time

I:E ratio

COPD 1:2 to 1:3
OHS, NM & CWD 1:1

Inspiratory time

0.8-1.2s COPD
1.2-1.5s OHS, NM & CWD

Use NIV for as much time as possible in 1st 24 hours.
Taper depending on tolerance & ABGs over next 48-72 hours
SEEK AND TREAT REVERSIBLE CAUSES OF AHRF

* Possible need for EPAP > 8

Severe OHS (BMI >35), lung recruitment eg hypoxia in severe kyphoscoliosis, oppose intrinsic PEEP in severe airflow obstruction or to maintain adequate PS when high EPAP required

NIV Monitoring

Oxygenation

Aim 88-92% in all patients

Note: Home style ventilators CANNOT provide > 50% inspired oxygen.

If high oxygen need or rapid desaturation on disconnection from NIV consider IMV.

Red flags

pH <7.25 on optimal NIV
RR persisting > 25

New onset confusion or patient distress

Actions

Check synchronisation, mask fit, exhalation port : give physiotherapy/bronchodilators, consider anxiolytic

CONSIDER IMV