



ECO CARDIOCHIRURGIA.it
VII CONGRESSO NAZIONALE – Milano, 5-7 maggio 2014

Il ventilatore e le interfacce; le modalità di ventilazione di interesse in Pronto Soccorso



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Azienda Ospedaliera Istituti Clinici di Perfezionamento
P.O. Bassini – Cinisello Balsamo - Milano

Quale interfaccia tra paziente e ventilatore?

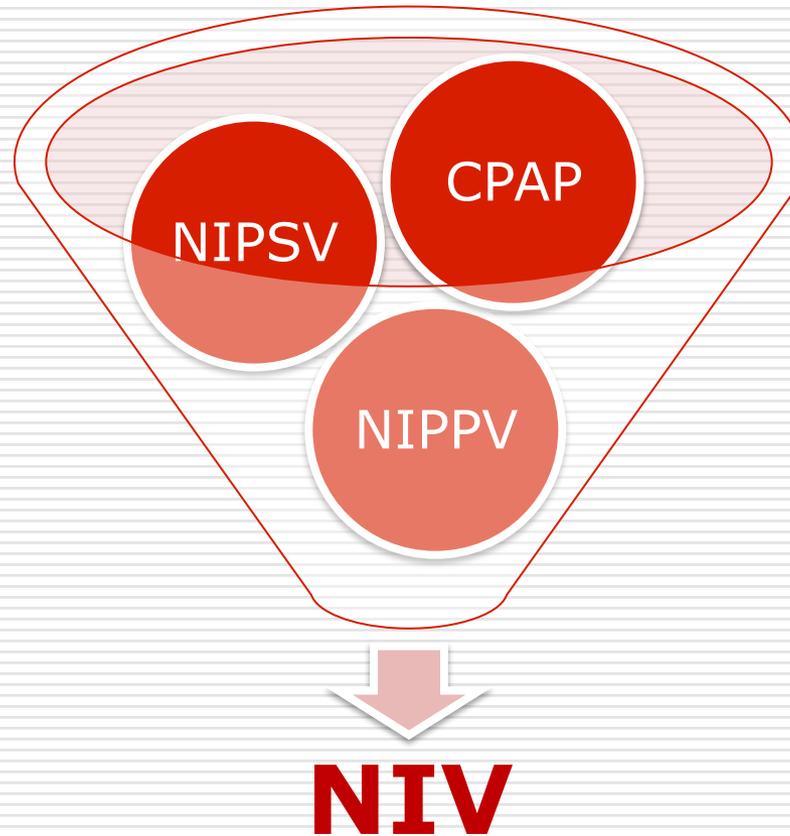


**ventilazione
invasiva**

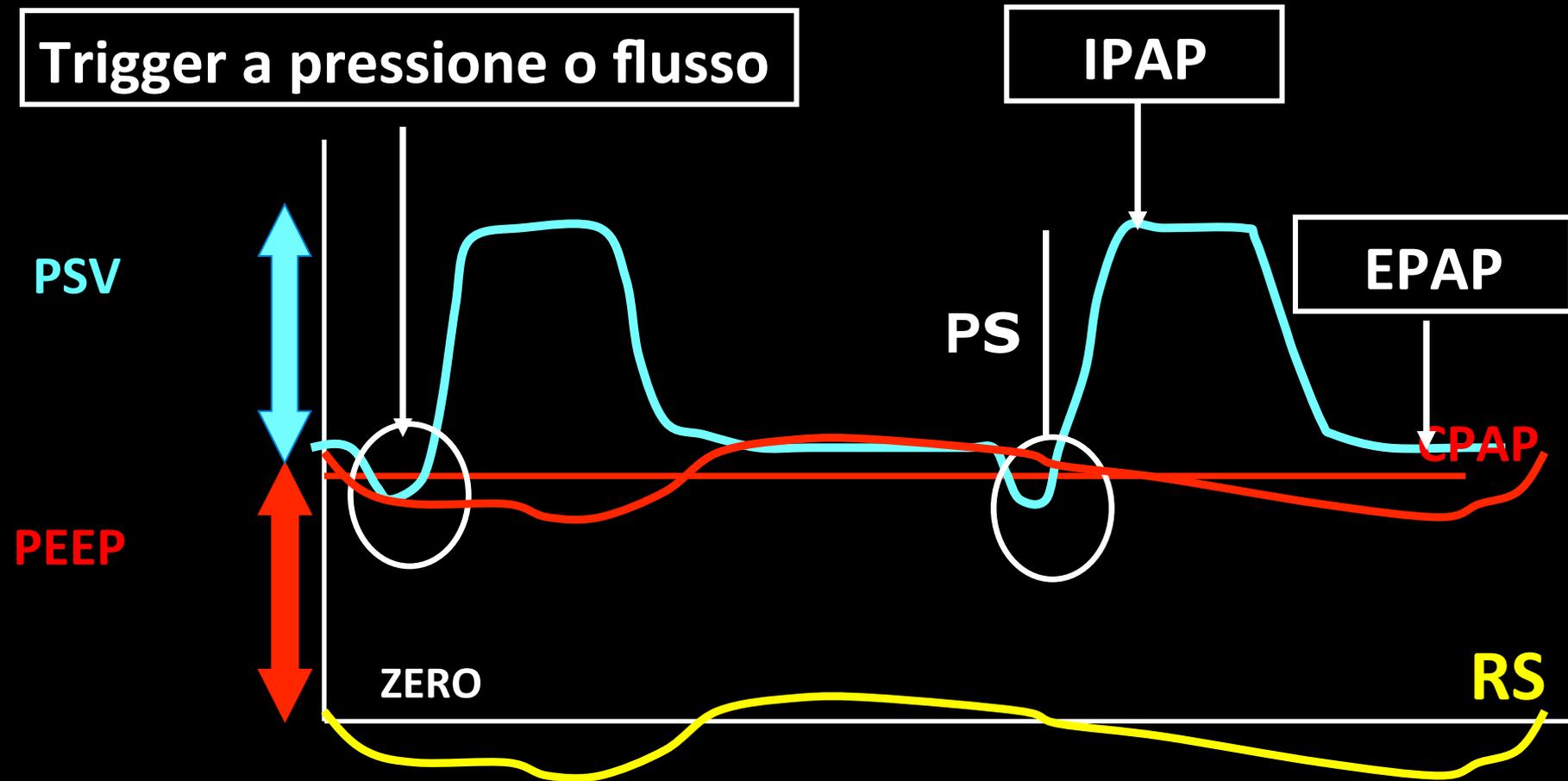


**ventilazione
non invasiva**

Terminologia

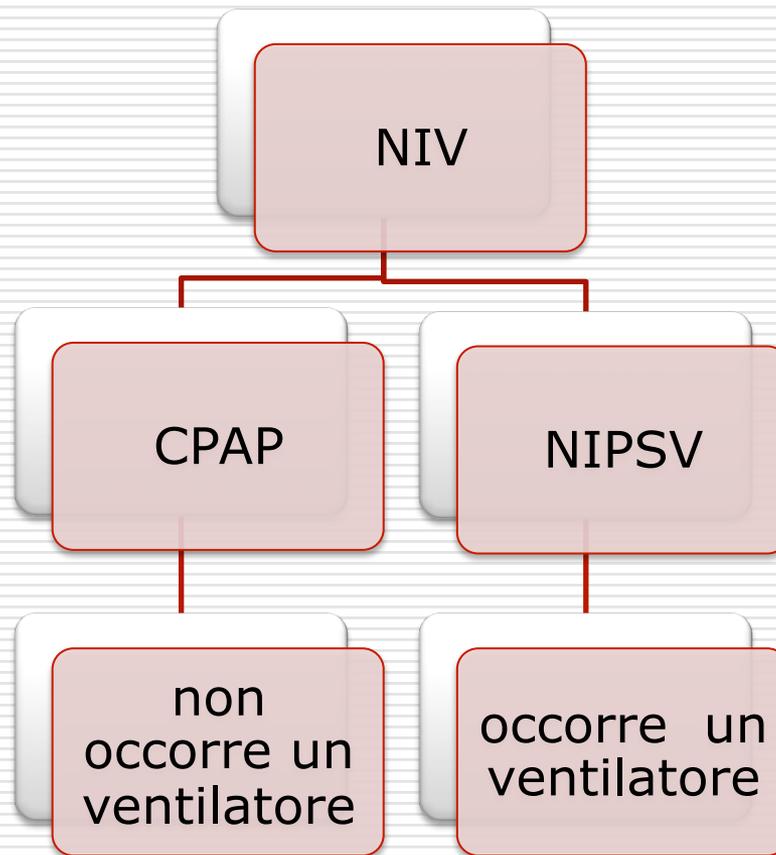


NIV in NIPSV (BiLevel o BiPAP): tecnica



RS, CPAP, NIPSV

cortesia dott.
G.P. Casella



NIV: obiettivi terapeutici generali

evitare l'intubazione tracheale

**evitare/ridurre la permanenza
in ICU e le relative complicanze**

**ridurre la durata della
degenza ospedaliera**

ridurre la mortalità

Linee guida più recenti

Canadian Critical Care Trials Group / Canadian Critical Care Society
Clinical practice guidelines for the use of noninvasive
positive-pressure ventilation and noninvasive continuous
positive airway pressure in the acute care setting

CMAJ, February 22, 2011, 183(3)

CLINICAL PRACTICE GUIDELINE

Clinical Practice Guideline: Non-Invasive Mechanical Ventilation as Treatment of Acute Respiratory Failure

Dtsch med Wochenschr 2013;
138(16): 825-830

NIV vs ventilazione invasiva: vantaggi

- < incidenza di VAP**
 - < incidenza di infezioni nosocomiali**
 - < durata della degenza in T.I.**
 - < mortalità**
-

Privilegiare la NIV nelle situazioni in cui si è dimostrata efficace

Strength of recommendations for the use of non-invasive ventilation (NIV) for the treatment of conditions involving acute respiratory failure (ARF), according to indication

Strength of indication for the use of NIV	Indication for NIV in ARF
High (multiple controlled studies)	COPD exacerbations Acute cardiogenic pulmonary edema ARF in immunosuppressed patients Weaning from the ventilator in COPD patients
Intermediate (few controlled studies/many case series)	Postoperative respiratory failure Avoidance of extubation failure Do-not-intubate order
Weak or not to be recommended	Acute respiratory distress syndrome (ARDS) Trauma Cystic fibrosis

TAKE HOME MESSAGE

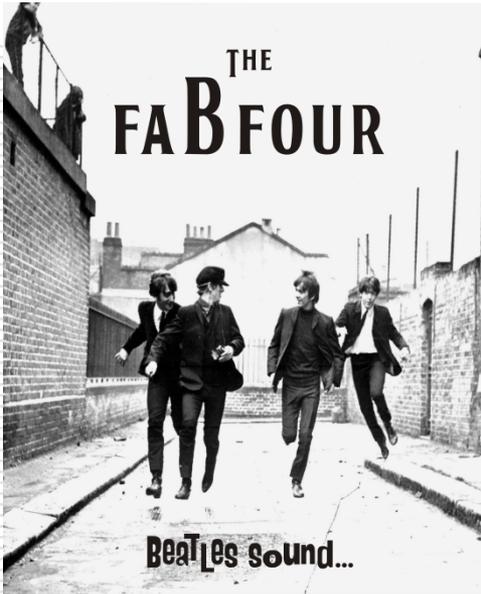
Strength of recommendations for the use of non-invasive ventilation (NIV) for the treatment of conditions involving acute respiratory failure (ARF), according to indication

Strength of indication for the use of NIV

High
(multiple controlled studies)

Indication for NIV in ARF

COPD exacerbations
Acute cardiogenic pulmonary edema
ARF in immunosuppressed patients
Weaning from the ventilator in COPD patients



**in queste patologie la
NIV dovrebbe essere il
trattamento di prima
scelta**

NIV: obiettivi terapeutici generali

evitare l'intubazione tracheale



**evitare/ridurre la permanenza
in ICU e le relative complicanze**

**ridurre la durata della
degenza ospedaliera**

ridurre la mortalità

Cosa dobbiamo sapere

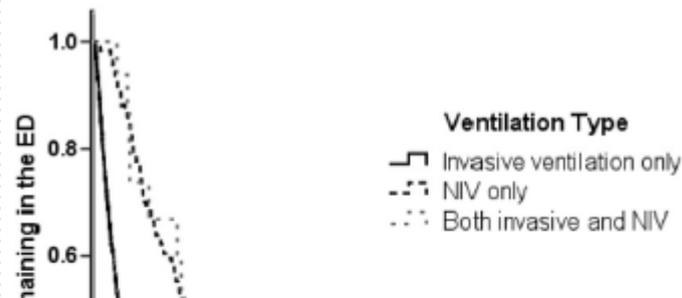
Esiste la possibilità di gestire la NIV nei reparti di degenza, al di fuori della T.I. ?

Esiste la possibilità di gestire la NIV in P.S. e quanto a lungo?

ORIGINAL RESEARCH

Open Access

Emergency department length of stay for patients requiring mechanical ventilation: a prospective observational study



I pazienti trattati con NIV restano in P.S. più a lungo dei pazienti intubati

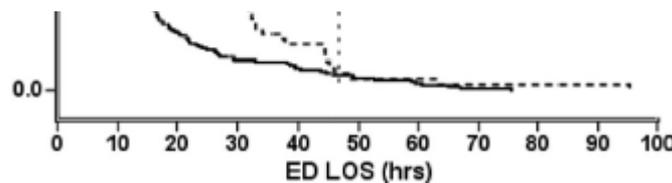


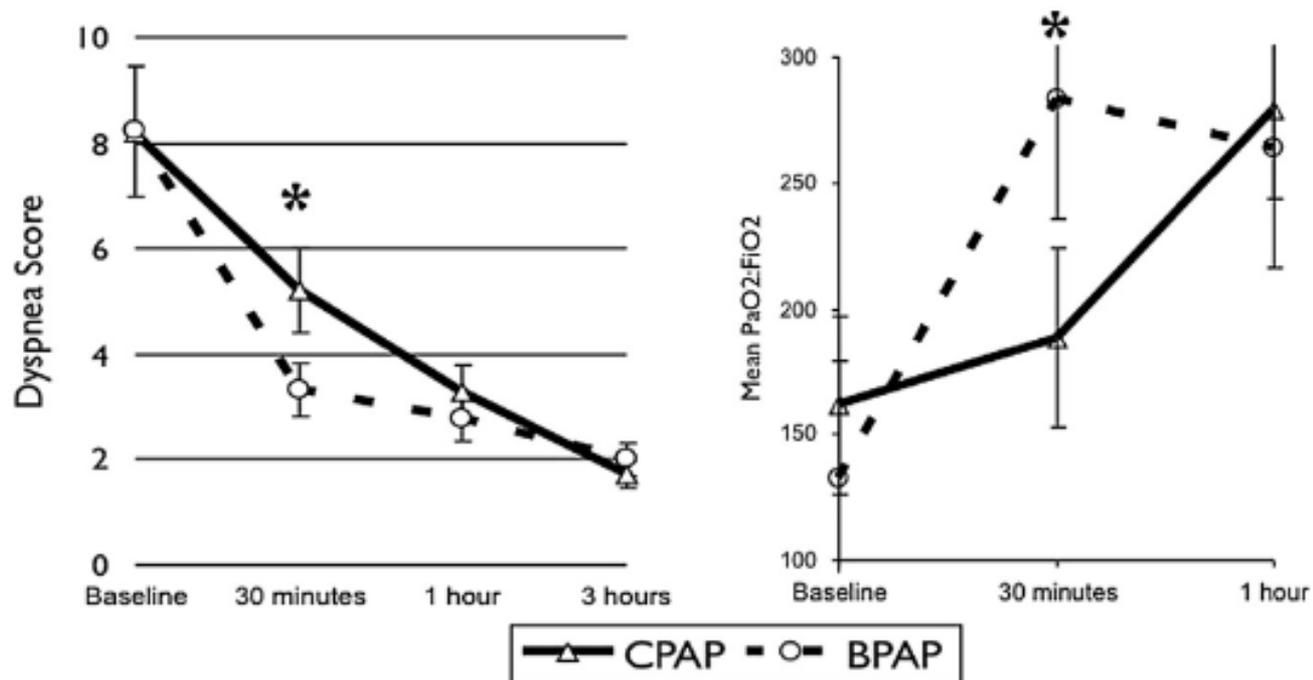
Figure 1 Kaplan-Meier Estimated Probability of Remaining in the ED. Legend: ___ = invasive ventilation only — = non-invasive ventilation only, — = both invasive and non-invasive ventilation.

Valutare l'efficacia: le prime una/due ore

Criterion	Success
Dyspnea	Decrease
Alertness	Gradual improvement
Respiratory rate	Decrease
Ventilation	Decrease in PaCO ₂
pH	Increase
Oxygenation	Rise of SaO ₂ to 85% or above
Heart rate	Decrease

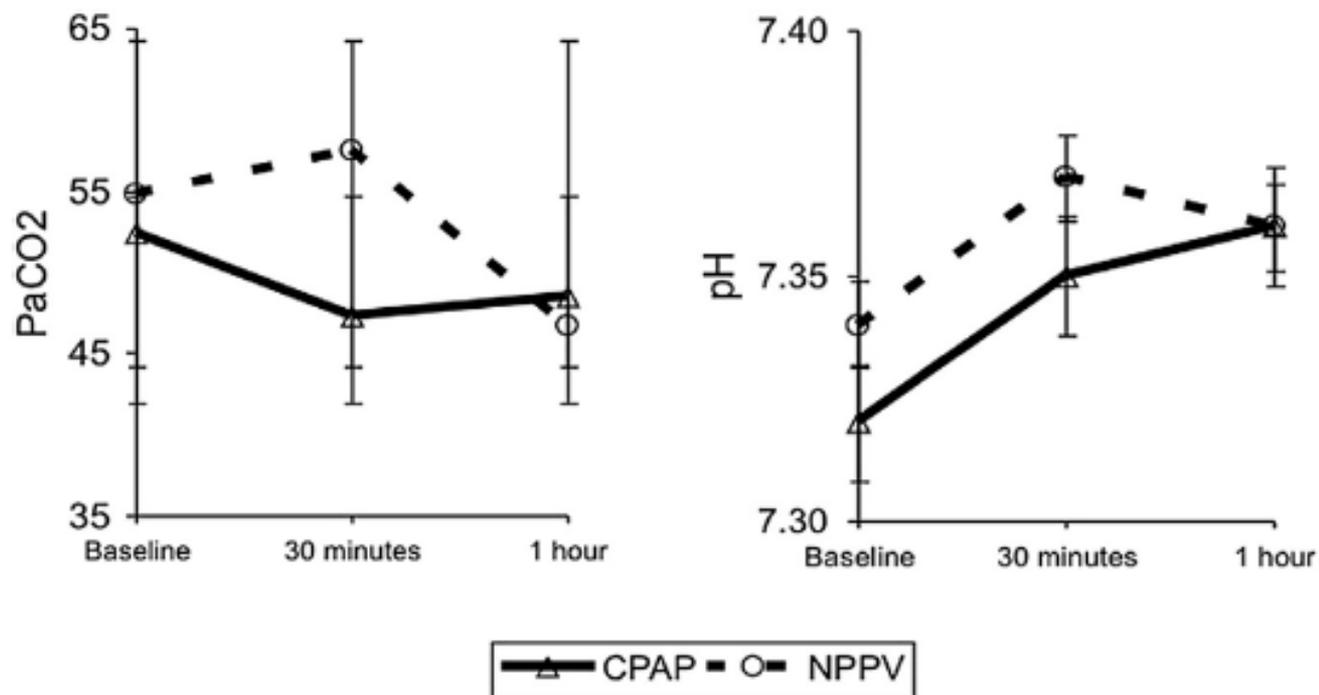
RANDOMIZED TRIAL OF BILEVEL VERSUS CONTINUOUS POSITIVE AIRWAY PRESSURE FOR ACUTE PULMONARY EDEMA

Timothy Liesching, MD,* David L. Nelson, RRT,† Karen L. Cormier, RRT,† Andrew Sucov, MD,‡
Kathy Short, RN, RRT,§ Rod Warburton, BA,|| and Nicholas S. Hill, MD||

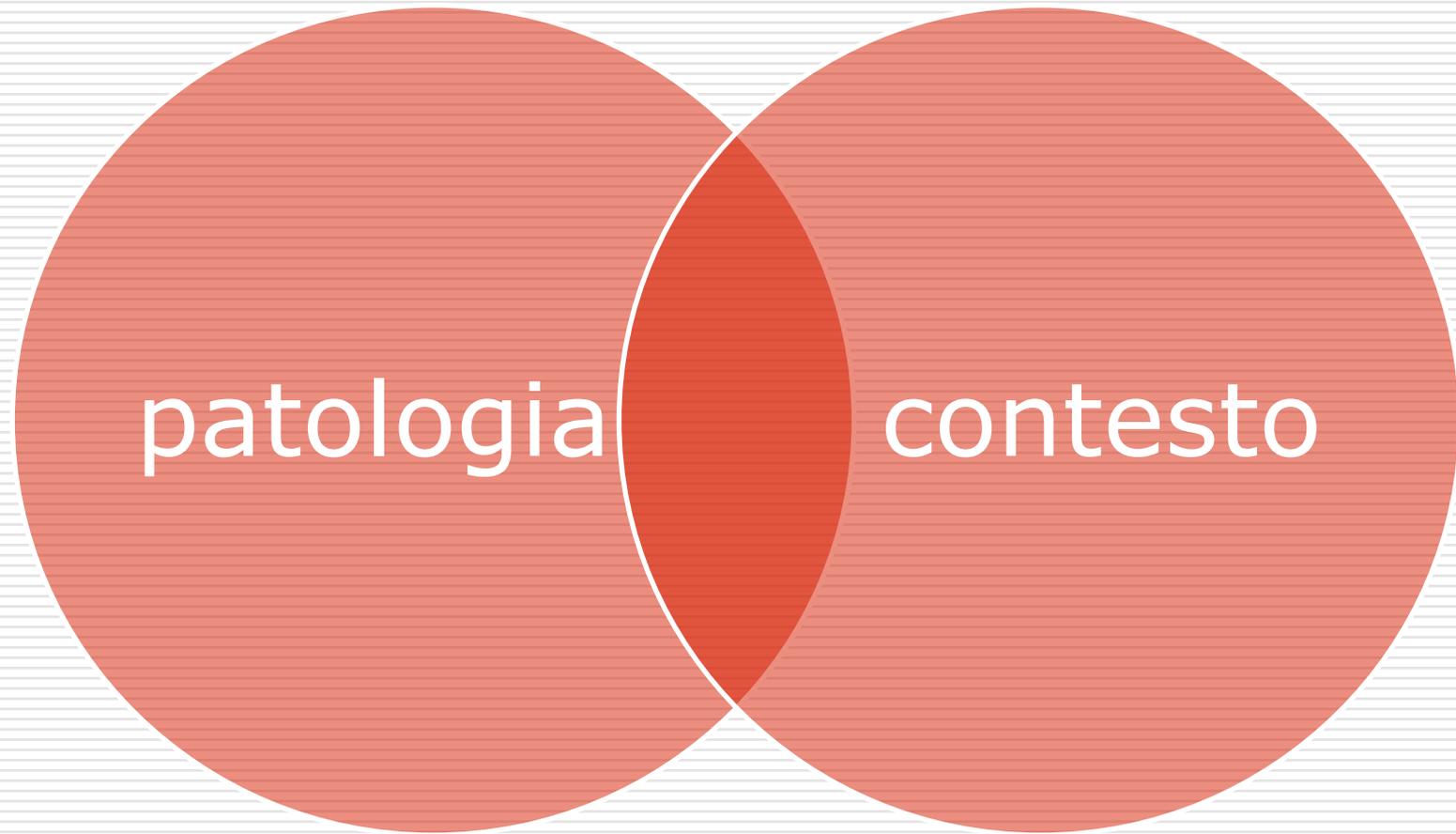


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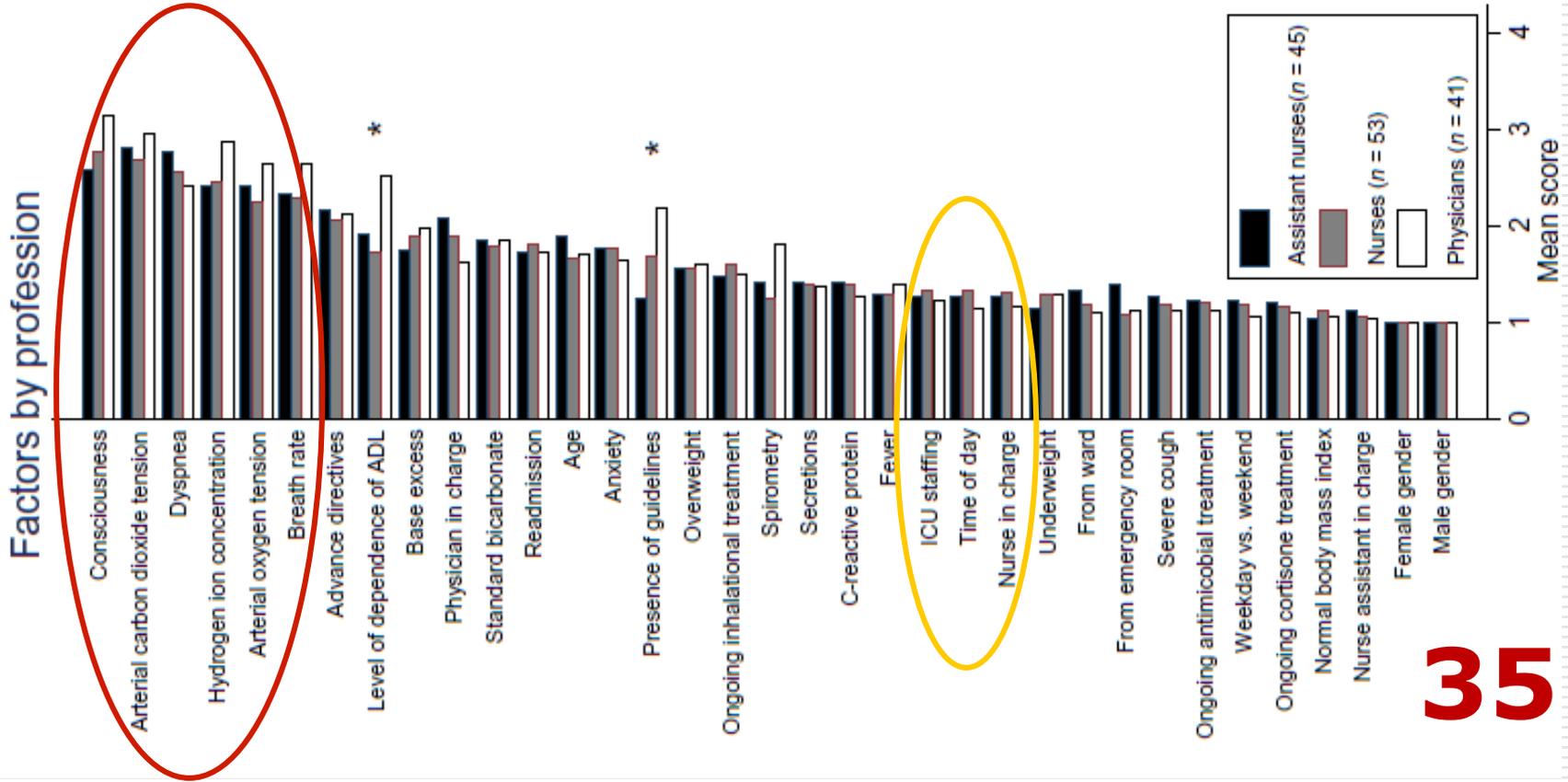
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Criteri di scelta



Fattori che influenzano la scelta



35

controindicazioni

Absolute contraindications

- Lack of spontaneous breathing; gasping
- Anatomical or functional airway obstruction
- Gastrointestinal bleeding or ileus

Relative contraindications

- Coma
- Massive agitation
- Massive retention of secretions despite bronchoscopy
- Severe hypoxemia or acidosis ($\text{pH} < 7.1$)
- Hemodynamic instability (cardiogenic shock, myocardial infarction)
- Anatomical and/or subjective difficulty gaining access to the airway
- Status post upper gastrointestinal surgery

**sono criteri assoluti
di ventilazione
invasiva**

**sono criteri
predittivi di
fallimento e quindi
di ventilazione
invasiva**

Fattori predittivi di fallimento patient-related

Paziente ipercapnico

- SAPS II > 34
- non collaborante
- pH =/↓ dopo 1-2 ore
- FR =/↑ dopo 1-2 ore
- RSBI > 105

Paziente ipossiémico

- SAPS II > 34
 - età avanzata
 - CAP ± sepsi
 - MOF
 - PaO₂/FiO₂ =/↓ dopo 1-2 ore
-

Quando la NIV fallisce...

Use of Noninvasive Ventilation in Patients with Acute Respiratory Failure, 2000–2009

A Population-Based Study

Allan J. Walkey¹ and Renda Soylemez Wiener^{2,3}

¹The Pulmonary Center, Division of Pulmonary and Critical Care Medicine, Department of Medicine, and ²The Pulmonary Center, Division of Pulmonary and Critical Care Medicine, Boston University School of Medicine, Boston, Massachusetts; and ³Center for Health Quality, Outcomes, & Economic Research, Edith Nourse Rogers Memorial VA Hospital, Bedford, Massachusetts

11.659.668 pazienti con insufficienza respiratoria acuta negli anni 2000-2009

Ann Am Thorac Soc Vol 10, No 1, pp 10–17, Feb 2013

La BPCO riacutizzata presenta la minor percentuale di fallimento: 13.4%

Table 2. Failure of noninvasive ventilation among patients without chronic obstructive pulmonary disease compared with patients with chronic obstructive pulmonary disease

Acute respiratory failure etiology	Adjusted odds ratio (95% confidence interval) for failure of noninvasive ventilation
Chronic obstructive pulmonary disease (n = 409,062)*	Reference
Sepsis (n = 12,962)	1.07 (0.97–1.19)
Heart failure (n = 153,489)	1.08 (1.04–1.13)
Asthma (n = 24,438)	1.18 (1.09–1.28)
Pneumonia (n = 78,162)	1.56 (1.48–1.63)
Neurological diagnosis (n = 9,075)	1.70 (1.51–1.93)
Other/unknown diagnosis (n = 55,591)	0.95 (0.89–1.01)

*Weighted n.

percentuale di fallimento: 20.7%

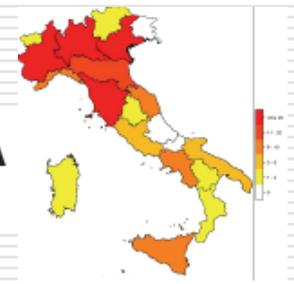
TAKE HOME MESSAGE

**I pazienti che vanno incontro a
fallimento della NIV, presentano
una mortalità maggiore**

adjusted odds ratio, 1.19; 95% confidence interval, 1.15–1.22; $P < 0.0001$

Ann Am Thorac Soc Vol 10, No 1, pp 10–17, Feb 2013

Progetto PROSAFE - Rapporto nazionale TI polivalenti (178 TI) - ITALIA
Maggio 2013



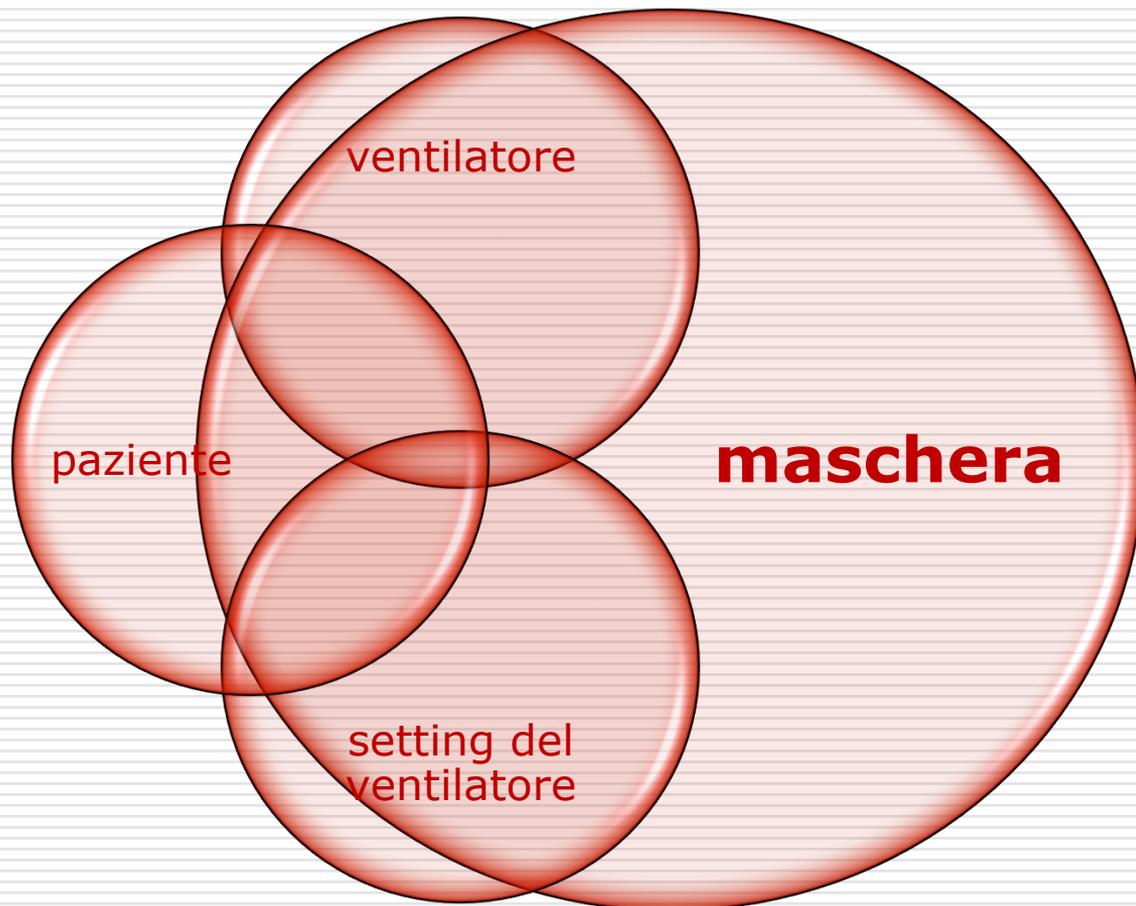
Rapporto nazionale TI polivalenti - Anno 2012
Indicatori di processo - Pazienti adulti

Ventilazione invasiva (N=38733)	N	%
Per insufficienza polmonare	12843	32.9
Per mantenimento vie aeree	12387	31.7
In svezzamento	9564	24.5
Non valutabile	4271	10.9
Reintubazione entro 48 ore	613	1.6

Ventilazione non invasiva (N=8141)	N	%
Sola ventilazione non invasiva	4084	50.2
Ventilazione non invasiva fallita	1275	15.7
Per svezzamento	2457	30.2
Altro	325	4.0
Missing	0	

→ **15.7%**

NIV: cause potenziali di fallimento



La maschera



One size does not fit all



nasale



full-face



total-face

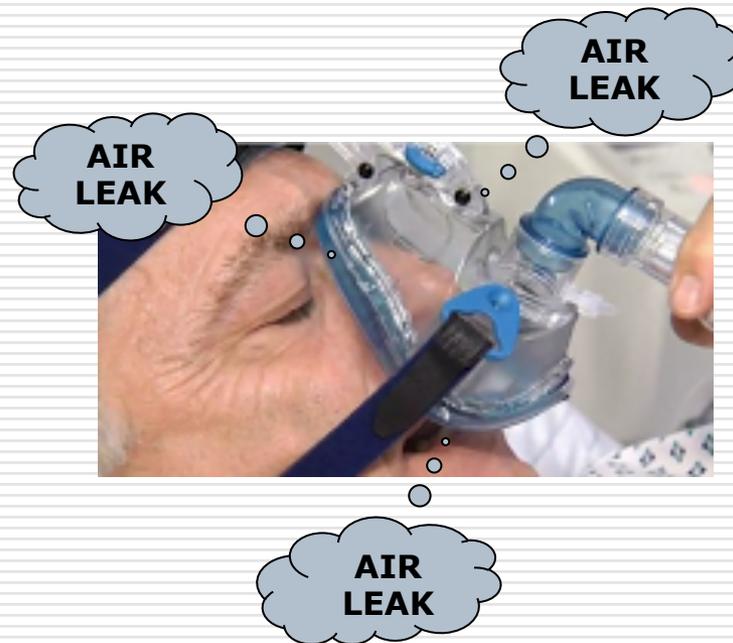


scafandro

Cosa dobbiamo sapere di una maschera

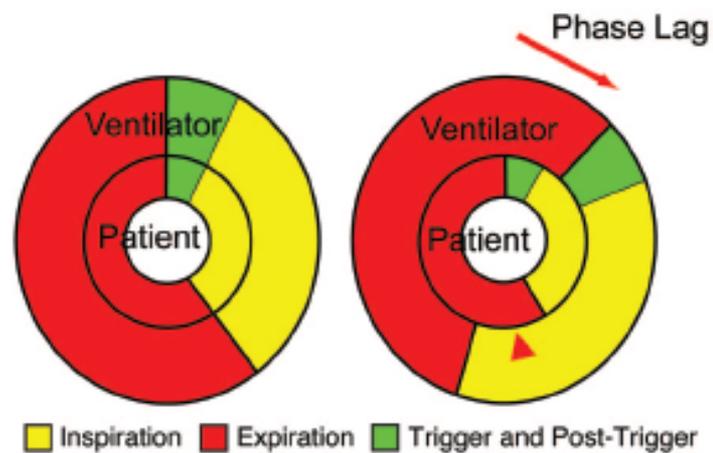
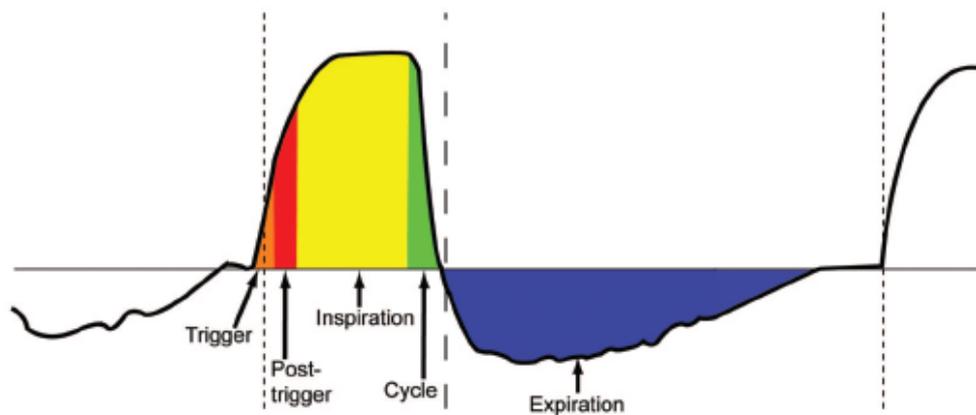
- ❑ che ha uno spazio morto variabile (nasale 120 ml; full-face 205 ml; in vivo 97 vs 118)
 - ❑ che può essere “ventilata” o no: cioè avere un port per l’espiazione passiva oppure no
 - ❑ attenzione alla scelta della maschera in relazione al tipo di circuito impiegato
-

Maschera = \pm air-leak

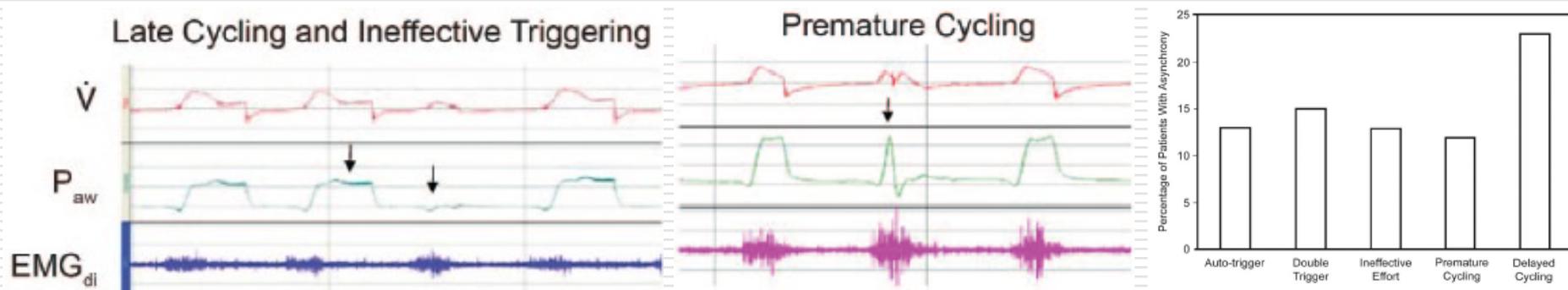
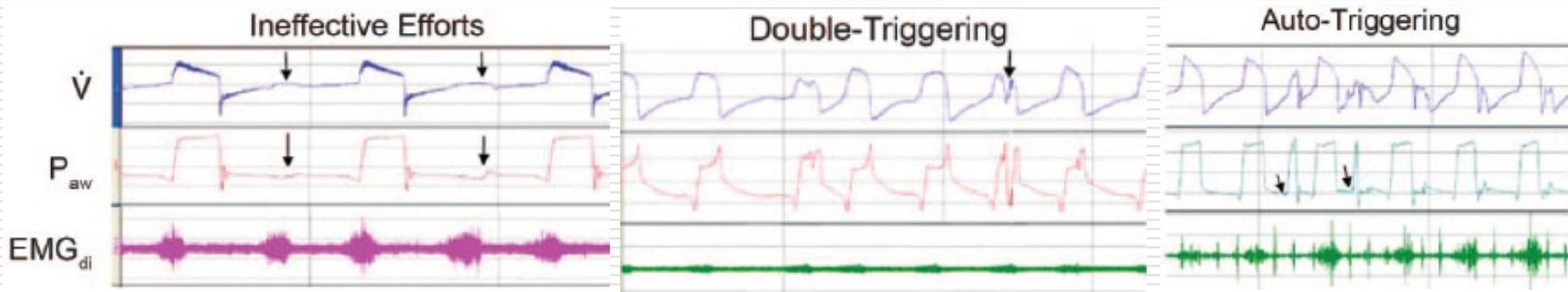


Maggiore l' air-leak, maggiore l' asincronia

Asincronia paziente-ventilatore



Asincronia paziente-ventilatore

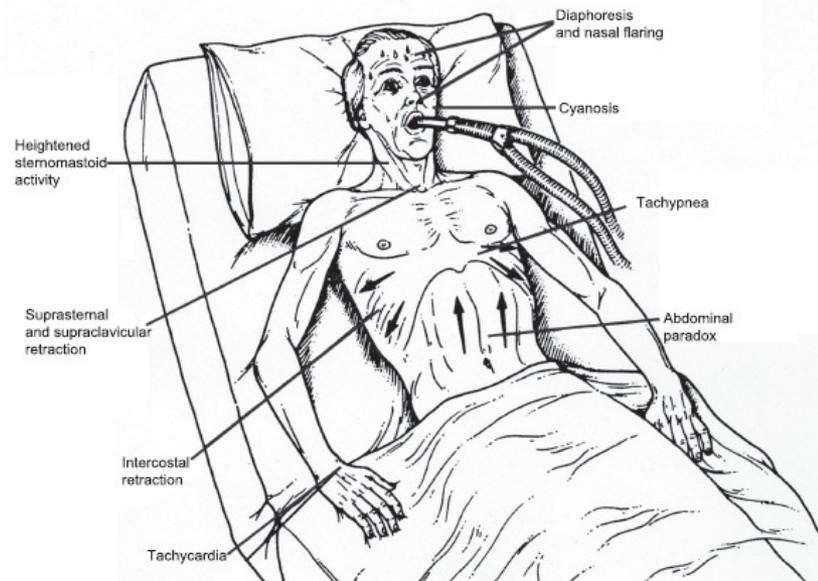


Asynchrony index (%)

$$\frac{\text{Numero di eventi}}{\text{RR (triggerati e no)}} \times 100\%$$

> 10% : valore significativo

Asincronia paziente-ventilatore



Tobin MJ, Alex CG. Discontinuation of mechanical ventilation. In: Tobin MJ, editor. Principles and practice of mechanical ventilation. New York: McGraw-Hill; 1994:1177-1206.

Adverse Consequences of Patient-Ventilator Asynchrony

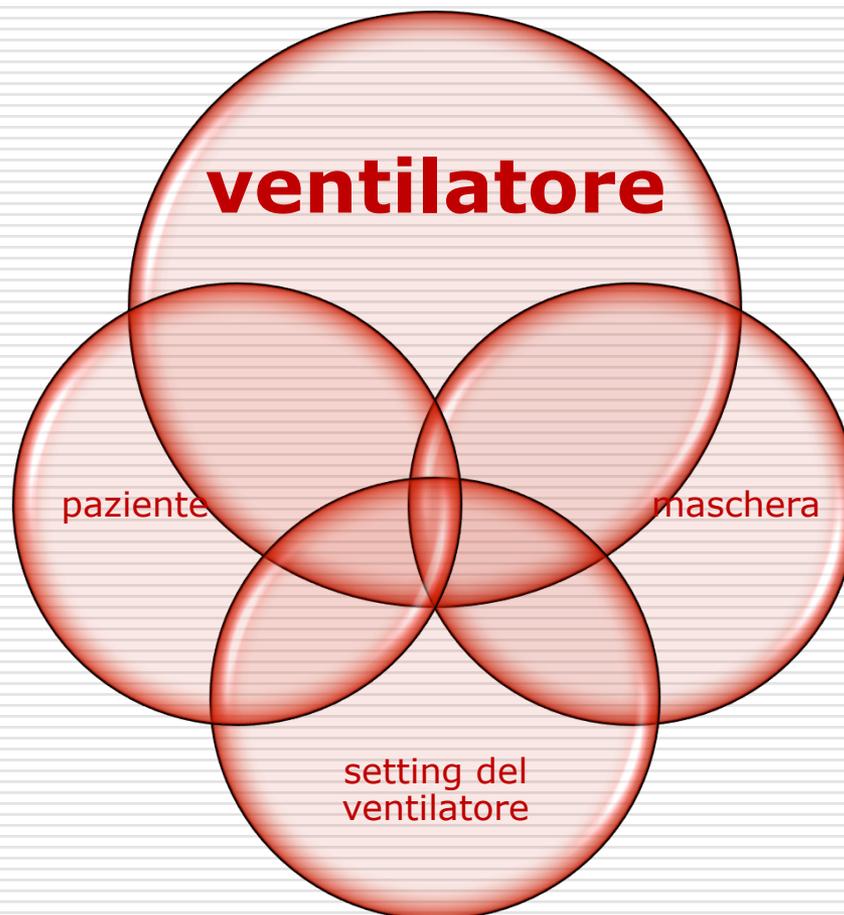
Ineffective ventilation
Hypoxemia
Lung over-distension
Dynamic hyperinflation
Increased work of breathing
Patient discomfort
"Fighting the ventilator"
Distress for family members and others at the bedside
Conflict among team members
Excessive administration of sedatives and neuromuscular blocking agents
Respiratory muscle dysfunction
Confusion with respect to readiness for weaning
Prolongation of mechanical ventilation
Neuromuscular complications of prolonged immobility

RESPIRATORY CARE • FEBRUARY 2011 VOL 56 NO 2

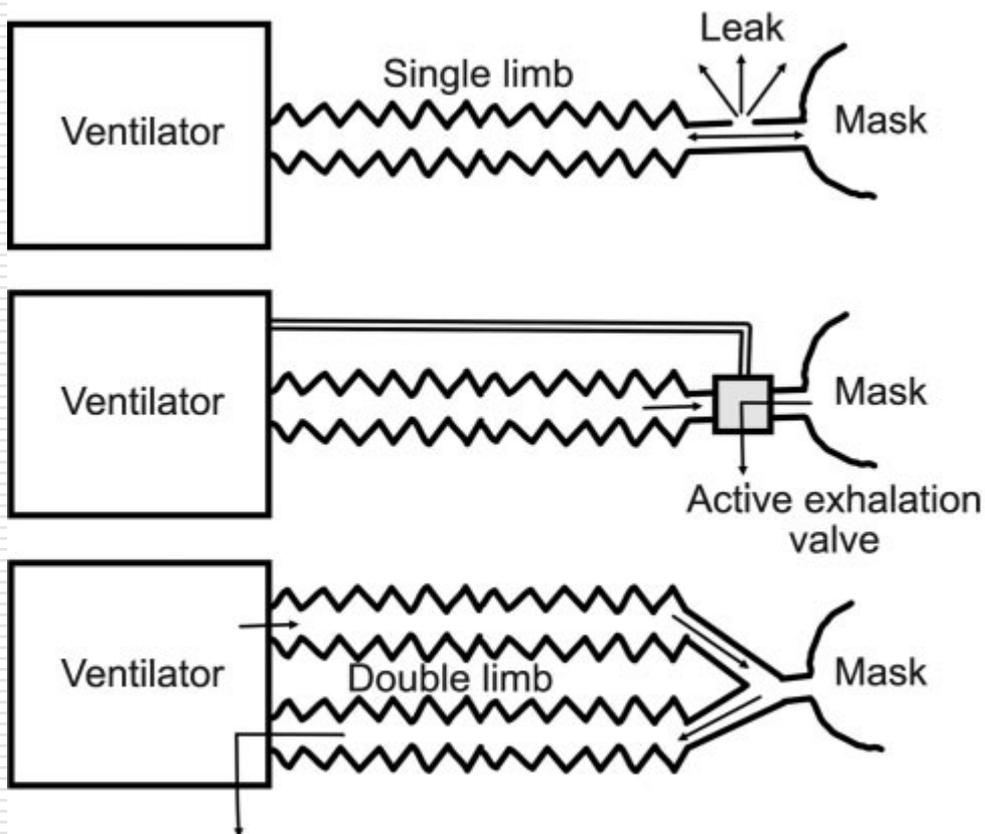
Leak compensation

I ventilatori devono disporre di algoritmi che permettano un adeguato compenso automatico delle perdite

NIV: cause potenziali di fallimento



Quale ventilatore ?



Ventilatori “bilevel”: monocircuito + exhalation port passivo
(leak-tolleranti)

Ventilatori da trasporto o da home-care: monocircuito o doppio circuito + exhalation port passivo o attivo

Ventilatori da “critical care”: doppio circuito + active exhalation port
(leak intolleranti)

Quale ventilatore ?

I ventilatori bilevel, proprio perché strutturati per compensare le perdite, offrono prestazioni superiori e garantiscono una miglior interazione ventilatore-paziente rispetto alle altre due categorie di ventilatori

Respir Care 2013;58(12):2027-2037.

A Comparison of Leak Compensation in Acute Care Ventilators During Noninvasive and Invasive Ventilation: A Lung Model Study

Jun Oto MD PhD, Christopher T Chenelle, Andrew D Marchese,
and Robert M Kacmarek PhD RRT FAARC



CHEST

Original Research

CRITICAL CARE

Patient-Ventilator Asynchrony During Noninvasive Ventilation

A Bench and Clinical Study

Guillaume Carreaux, MD; Aissam Ljazidi, PhD; Ana Cordoba-Izquierdo, MD; Laurence Vignaux; Philippe Jolliet, MD; Arnaud W. Thille, MD, PhD; Jean-Christophe M. Richard, MD, PhD; and Laurent Brochard, MD

CHEST 2012; 142(2):367-376

Intensive Care Med (2010) 36:2053-2059
DOI 10.1007/s00134-010-1994-2

ORIGINAL

Laurence Vignaux
Didier Tassaux
Guillaume Carreaux
Jean Roeseler
Lise Piquilloud
Laurent Brochard
Philippe Jolliet

Performance of noninvasive ventilation algorithms on ICU ventilators during pressure support: a clinical study

Grazie



Totem #8