NIV IN CORSO DI BPCO RIACUTIZZATA

Dr Livio Colombo

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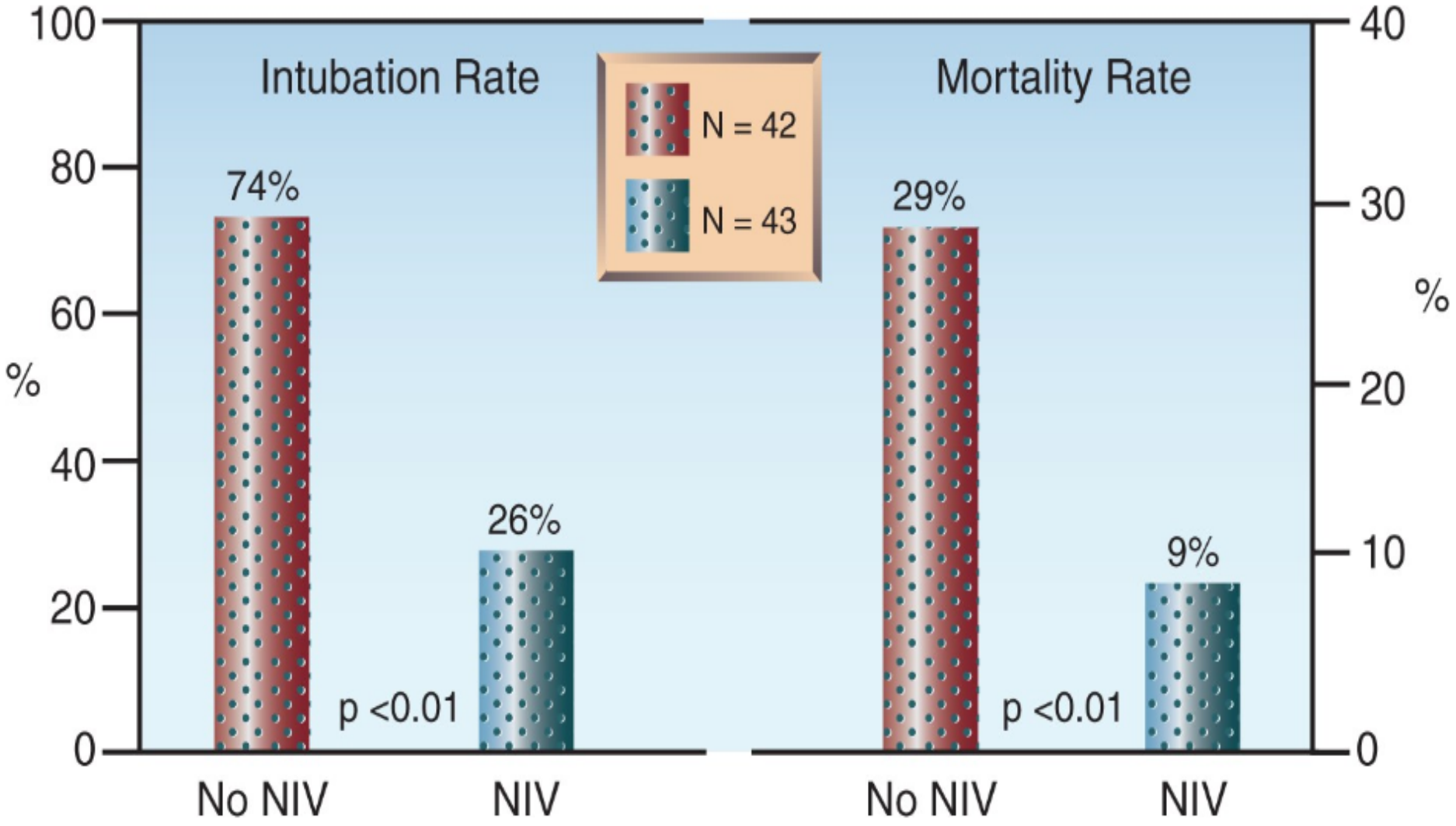
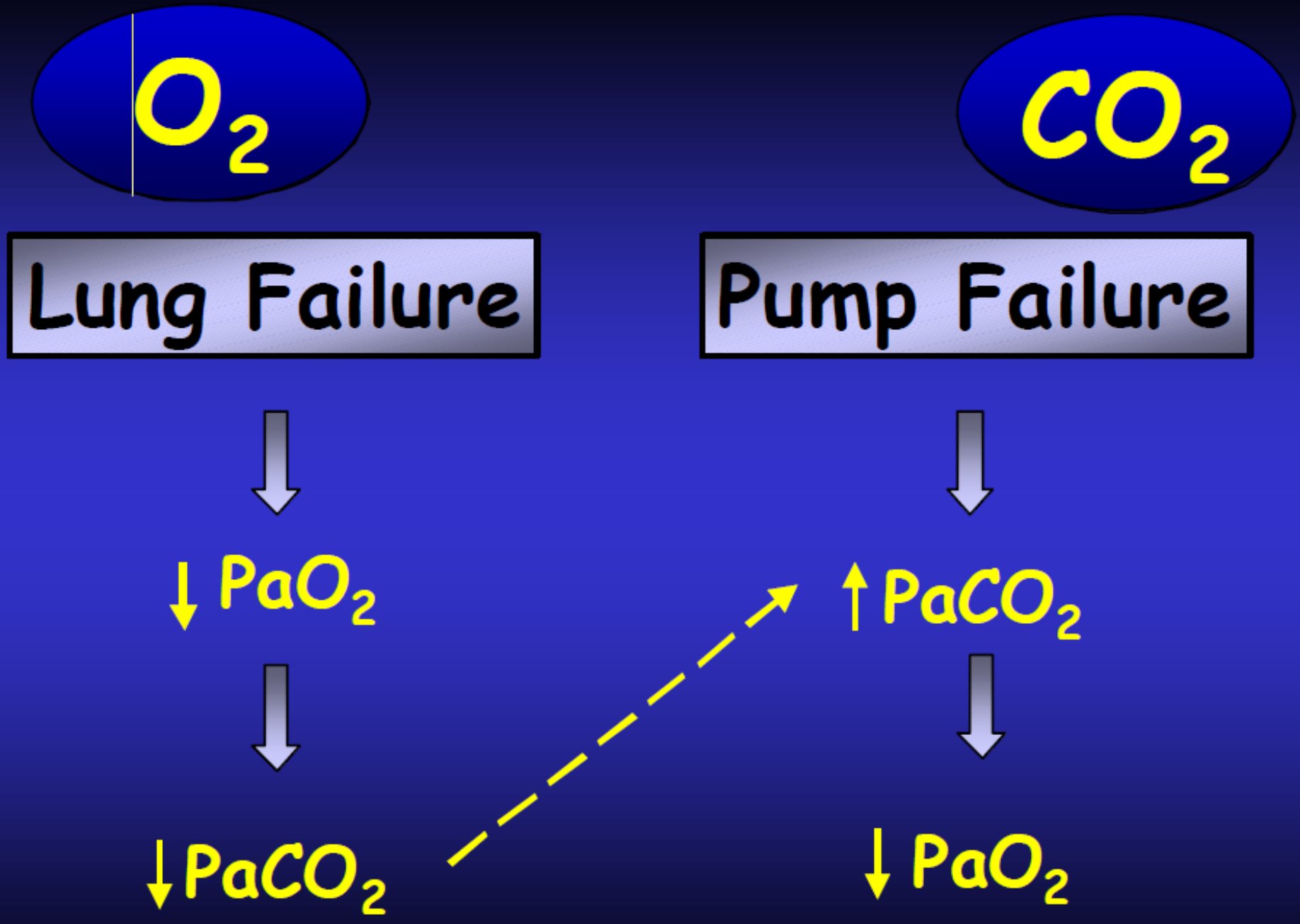
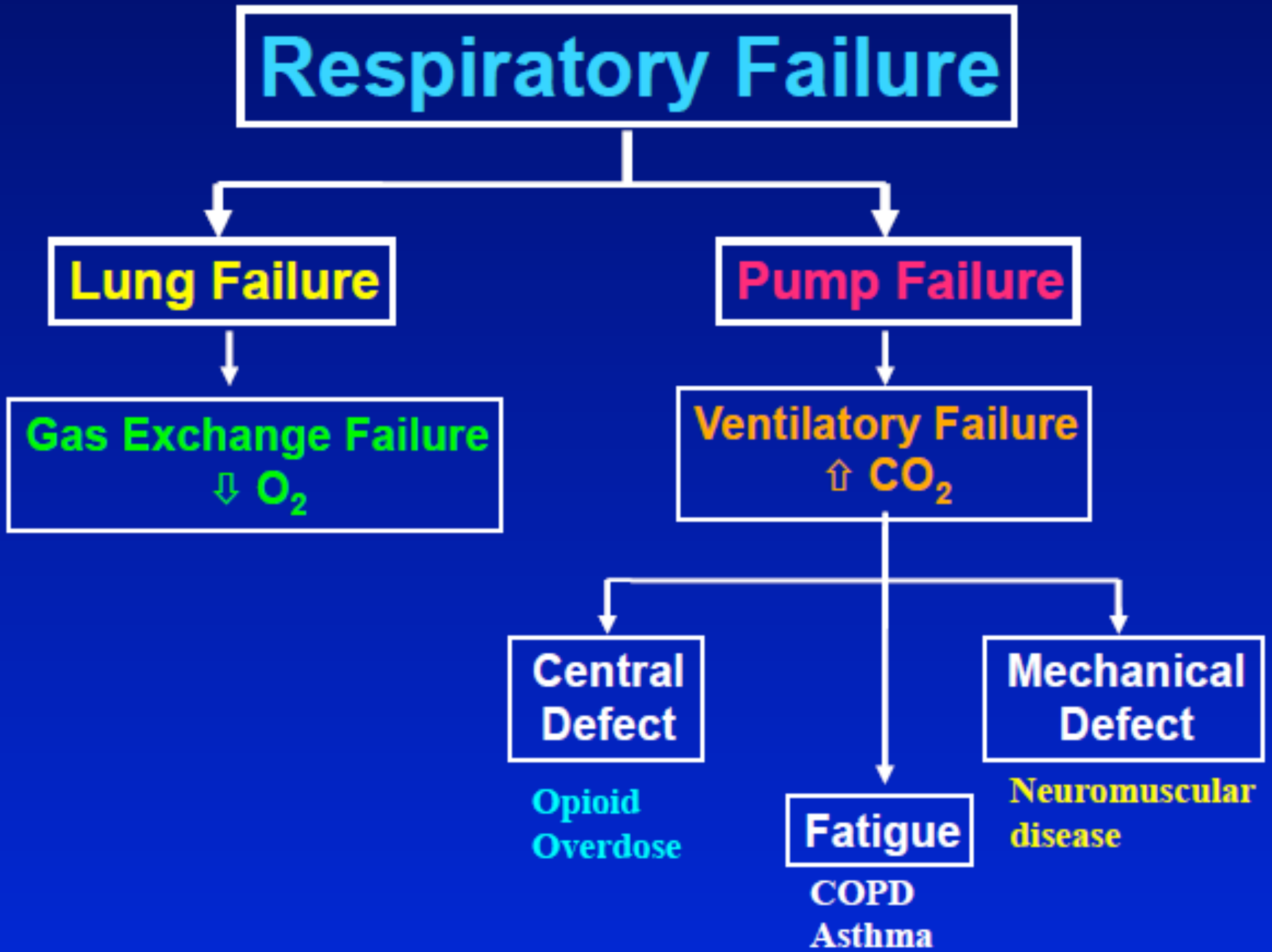

Intubation Rate
Mortality Rate
N = 42
N = 43
74%
26%
29%
9%
p <0.01
p <0.01
100
80
60
40
20
0
%
40
30
20
10
0
%
No NIV
NIV
No NIV
NIV


O_2
CO_2
Lung Failure
Pump Failure
$\downarrow PaO_2$
$\downarrow PaCO_2$
$\uparrow PaCO_2$
$\downarrow PaO_2$


Respiratory Failure
Lung Failure
Pump Failure
Gas Exchange Failure
⇩ O2
Ventilatory Failure
⇧ CO2
Central Defect
Mechanical Defect
Opioid Overdose
Fatigue
Neuromuscular disease
COPD
Asthma

Ventilazione polmonare totale = volume corrente X frequenza respiratoria

$$\dot{V}E = VT \times FR$$

5-10 l/min = 500 cc X 8-12 atti/min

Volume corrente = volume alveolare + volume spazio morto

$$VT = VA + VD$$

500 cc = 350 cc + 150 cc

Ventilazione Alveolare = ventilaz polmonare totale- ventilaz spazio morto

$$\dot{V}A = \dot{V}E - \dot{V}D = (VT - VD) \times FR$$

3.5 l/min = 350 cc X 8-12 atti/min

Aumento CO_2 -Ipoventilazione alveolare

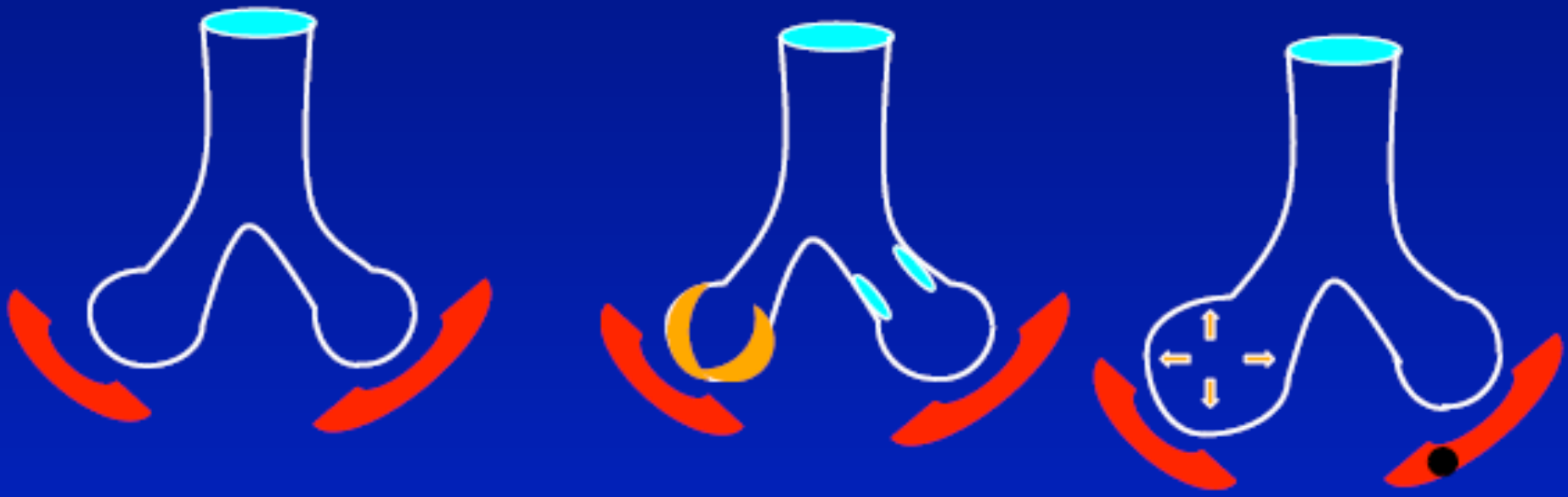
- **Il Volume di gas fresco che arriva agli alveoli nell'unità di tempo (Ventilazione <u>alveolare</u> – Va) è diminuito**
- **Provoca <u>sempre</u> un aumento della pCO2**

pCO2 = (VCO2/Va) x k { **VCO2 = quantità di CO2 eliminata nell'unità di tempo**

Va = Ventilazione alveolare = (Vt – Vd) x FR

→ **Va e pCO2 sono inversamente proporzionali**

Riduzione O_2 -Alterazioni rapporto ventilazione/perfusione



EPA
Polmonite

Asma
BPCO

Enfisema

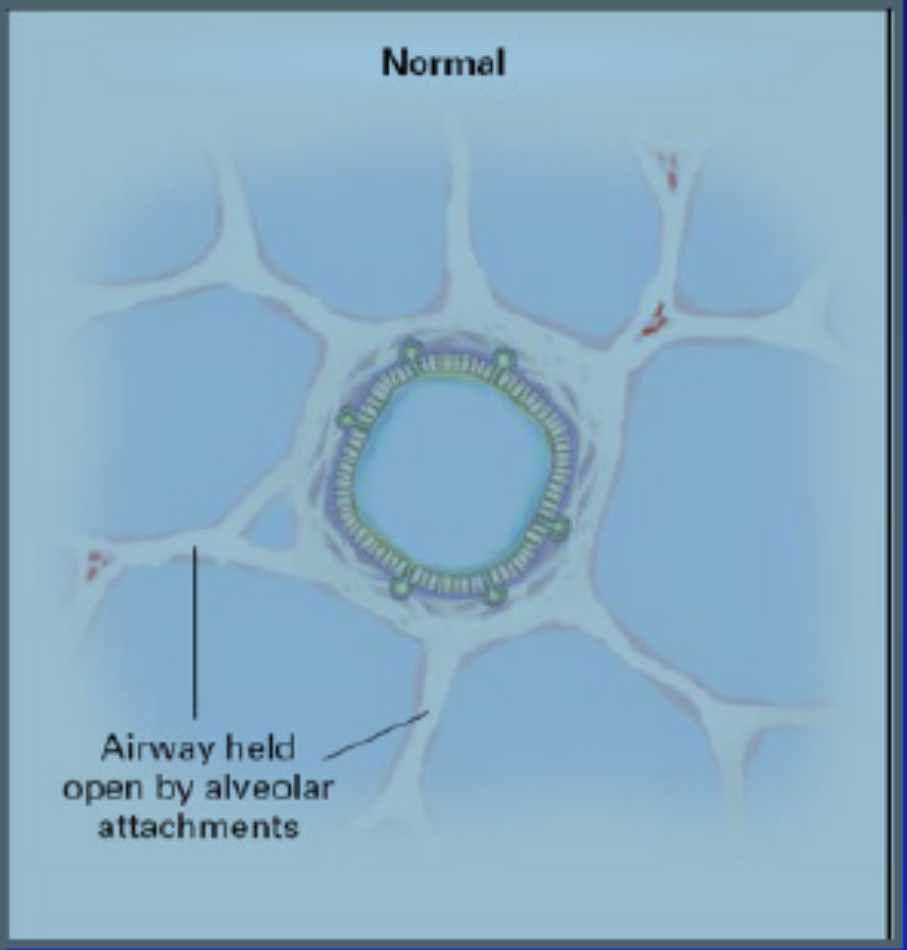
TEP

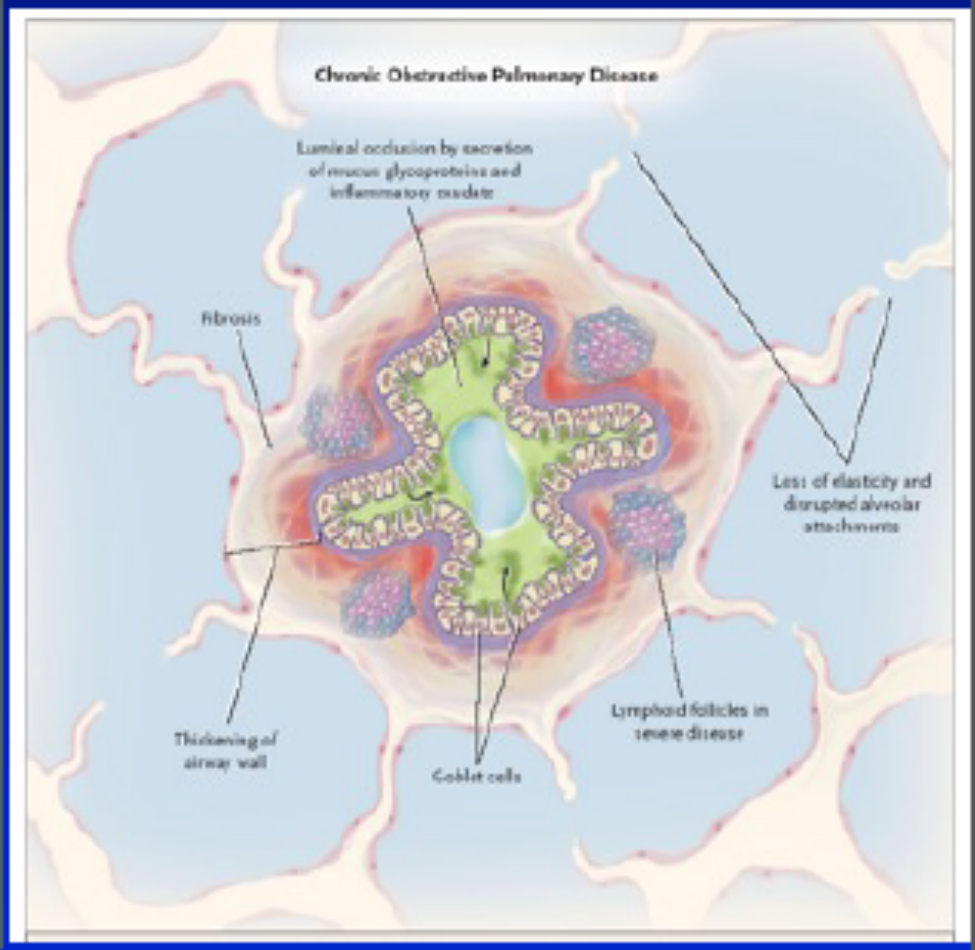
$\dot{V}/\dot{Q}$ normale

$\dot{V}/\dot{Q}$ ridotto

$\dot{V}/\dot{Q}$ aumentato

Alterazioni morfologiche delle vie aeree in corso di BPCO

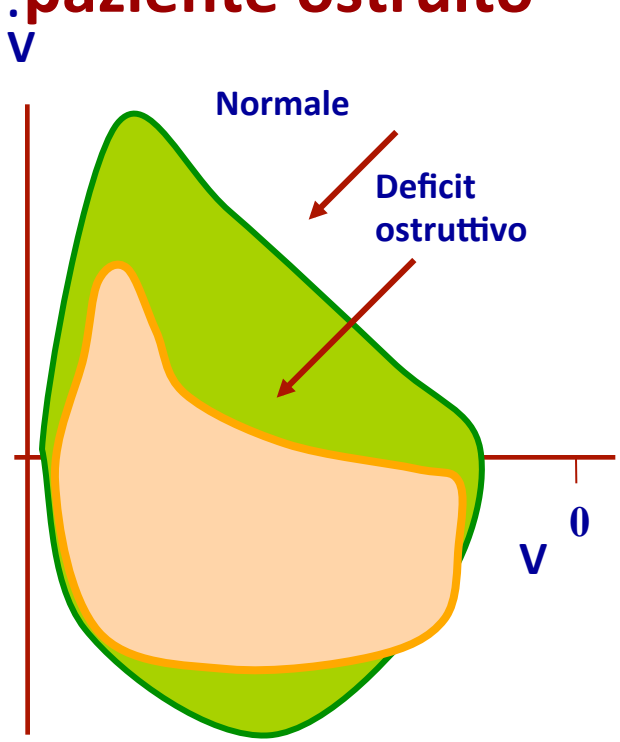




Barnes PJ. N Engl J Med 2004;350:2635-37

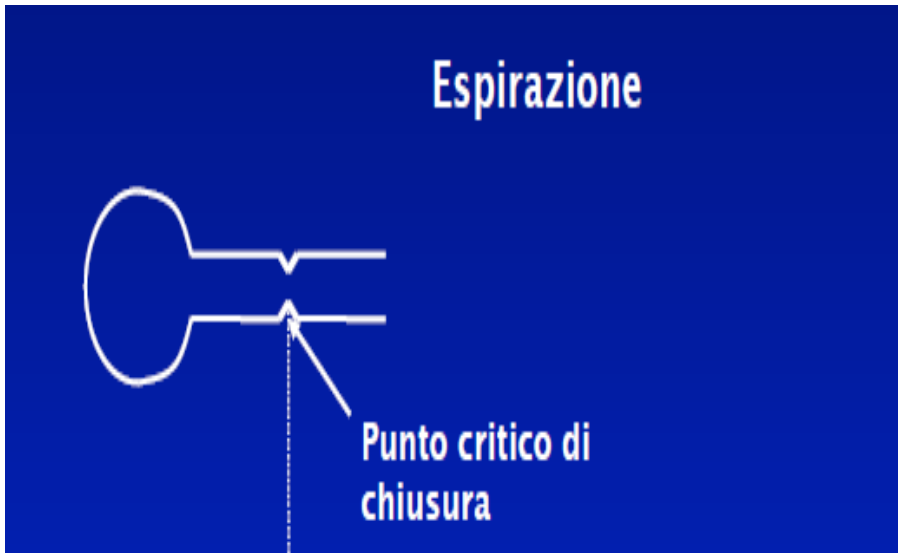
Curva flusso-volume

- **Curva flusso-volume espiratoria normale e in un paziente ostruito**



Nel paziente con ostruzione bronchiale si rileva una riduzione dei flussi a tutti i volumi polmonari con riduzione del PEF e concavità verso l'alto della curva espiratoria (freccia).

CHIUSURA DINAMICA VIE AEREE



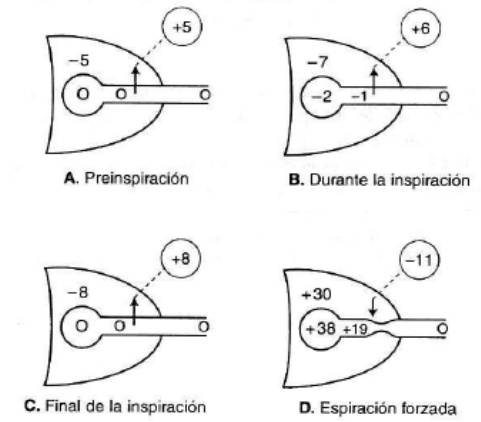
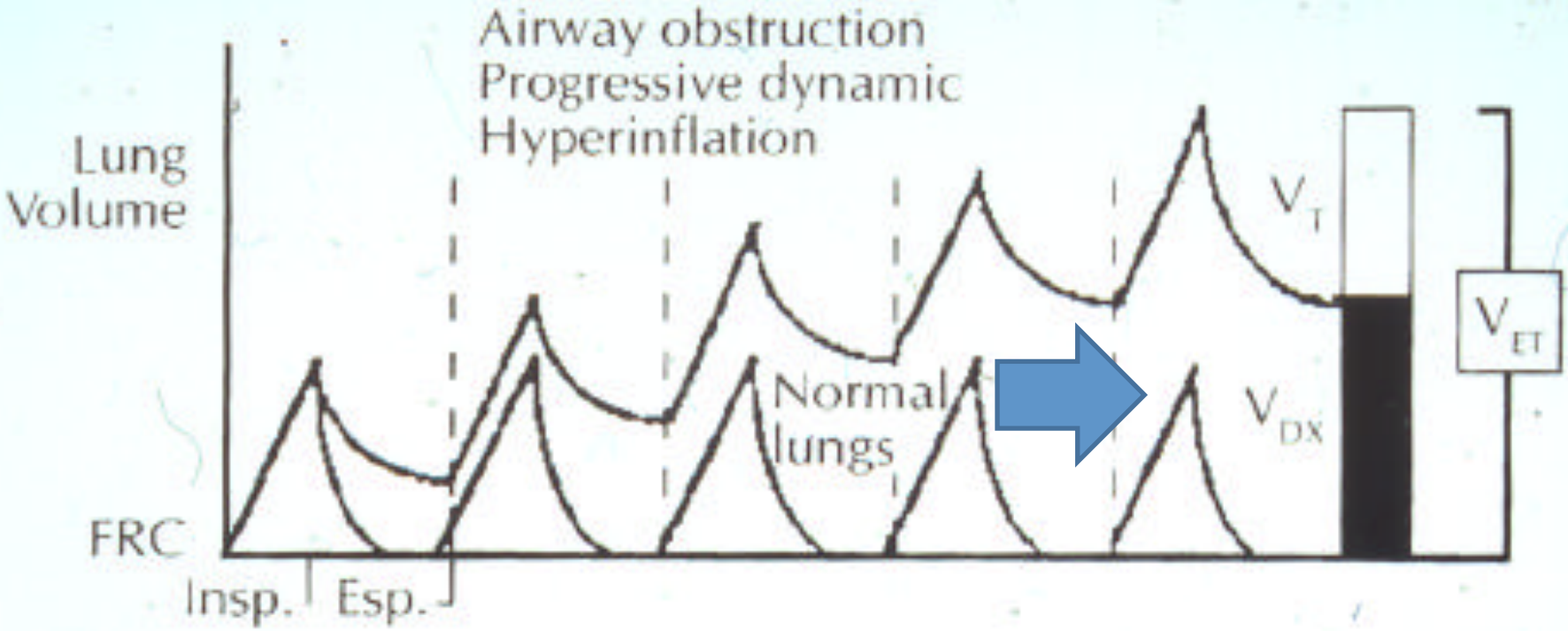


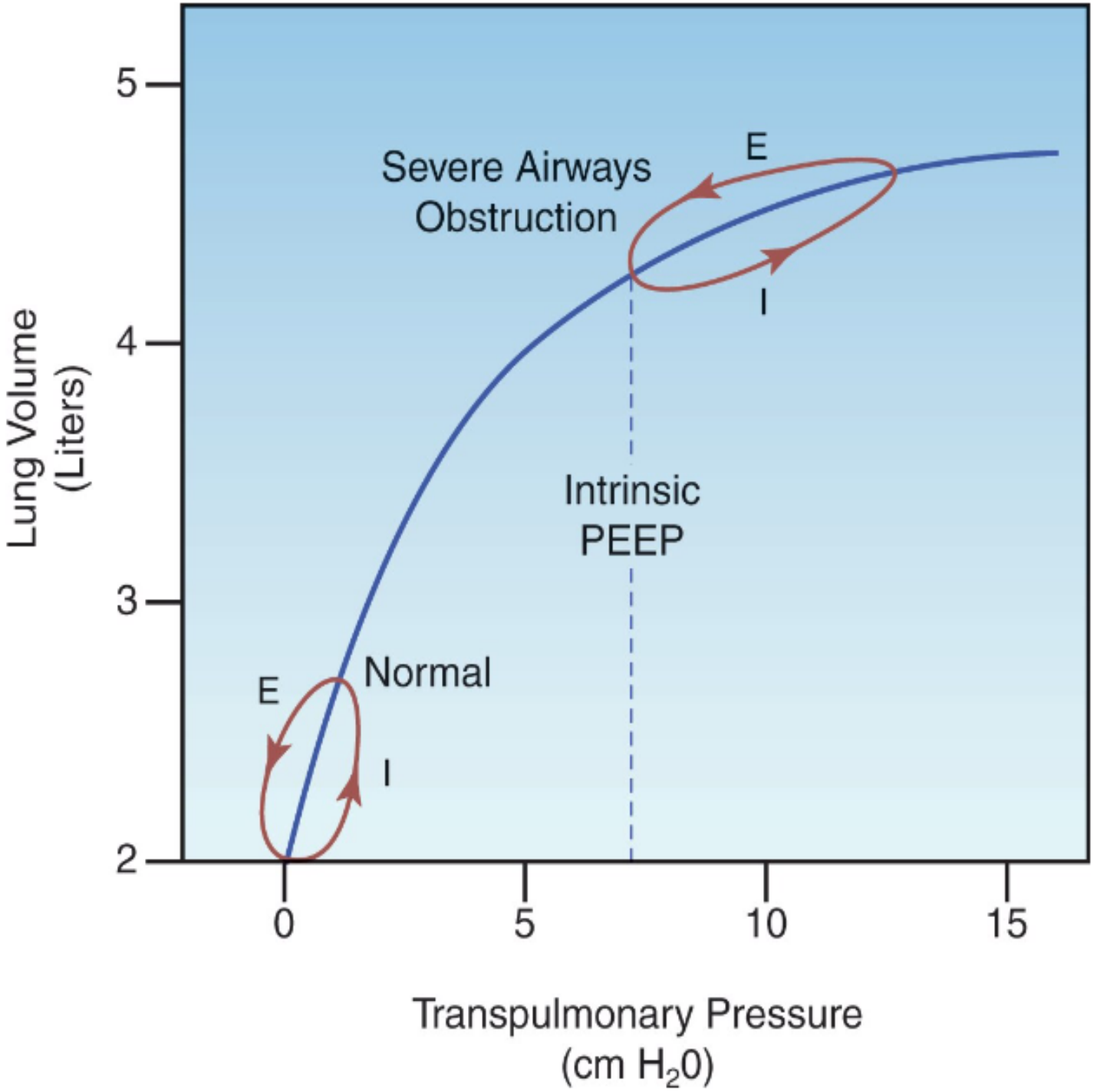
Fig. 7-18. Esquema que demuestra por qué las vías aéreas se comprimen durante la espiración forzada. La presión a través de la vía aérea mantiene abierta a ésta, salvo durante la espiración forzada. Véanse los detalles en el texto.

Compresión dinámica de las vías aéreas

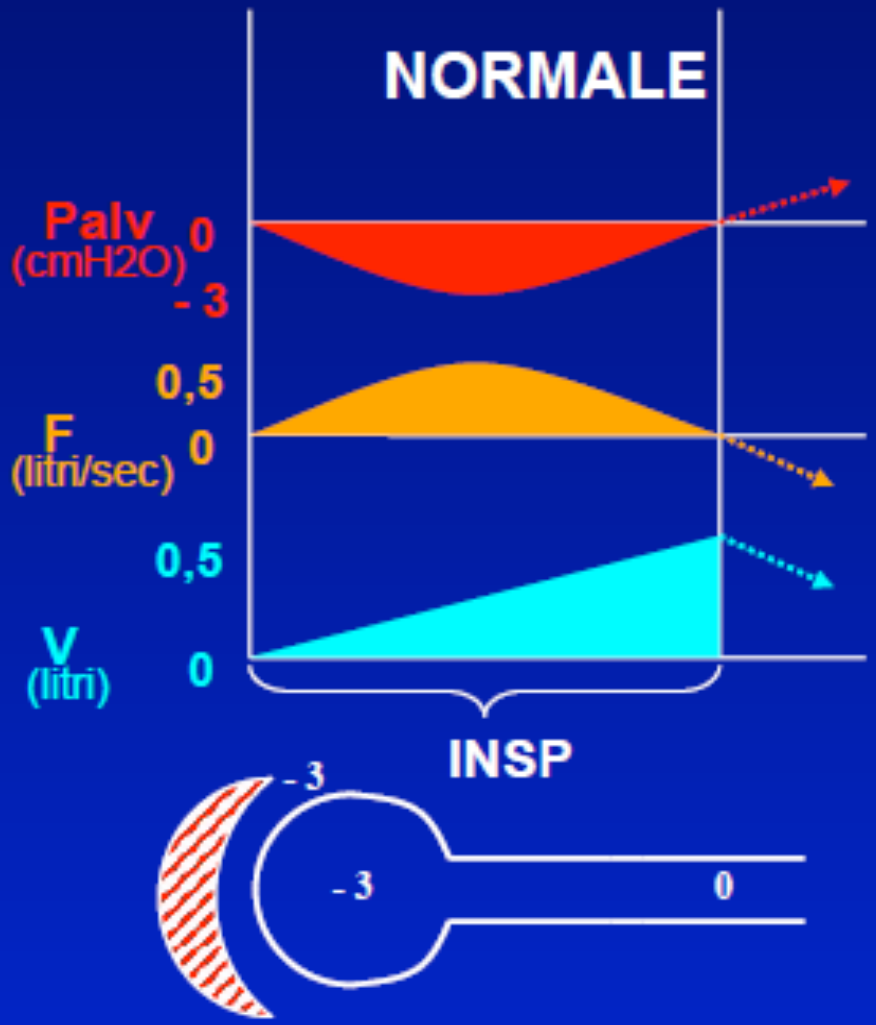
- Limita el flujo aéreo en personas normales durante la espiración forzada
- Puede aparecer en las neumopatias con flujos espiratorios relativamente bajos, reduciendo la capacidad de realizar ejercicio
- Durante la compresión dinámica el flujo se halla determinado por la presión alveolar menos la presión pleural (no la presión en la boca)
- Está exagerada en algunas enfermedades pulmonares por la disminución del retroceso elástico pulmonar y la pérdida de la tracción radial en las vías aéreas

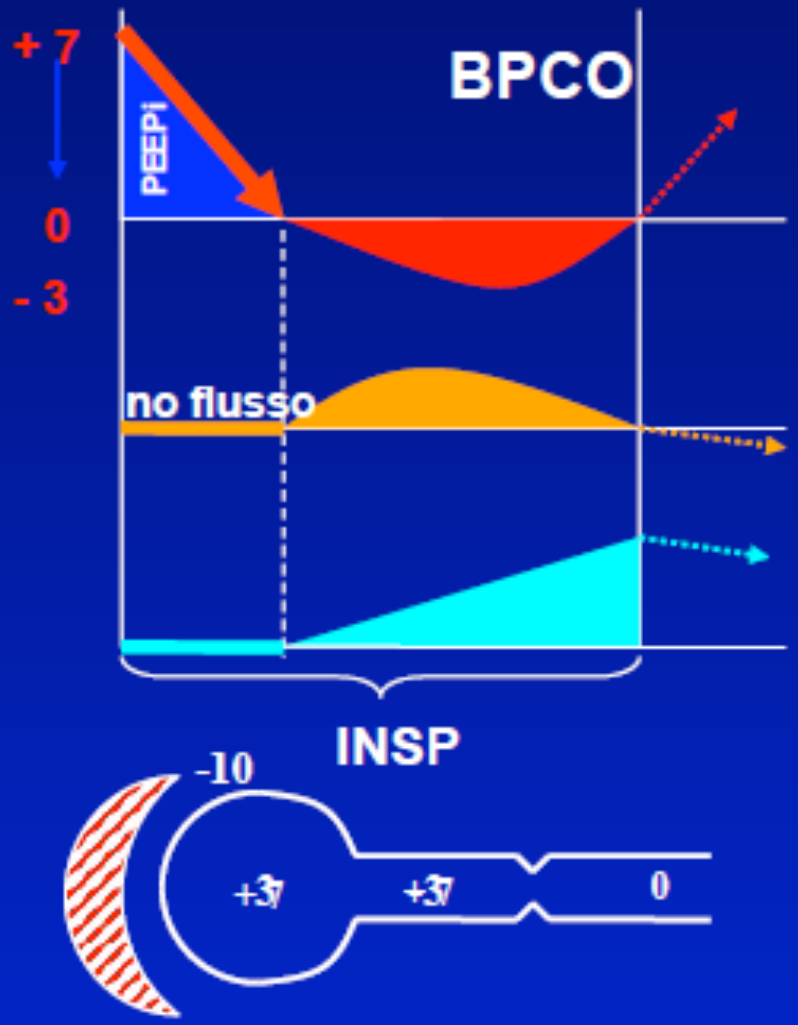


PEEP INTRINSECA (occulta o autoPEEP): per iperinflazione dinamica la fase esp non si completa prima della successiva insp > ⇧ volume intrappolato > ⇧ CFR > modifica della curva volume/pressione

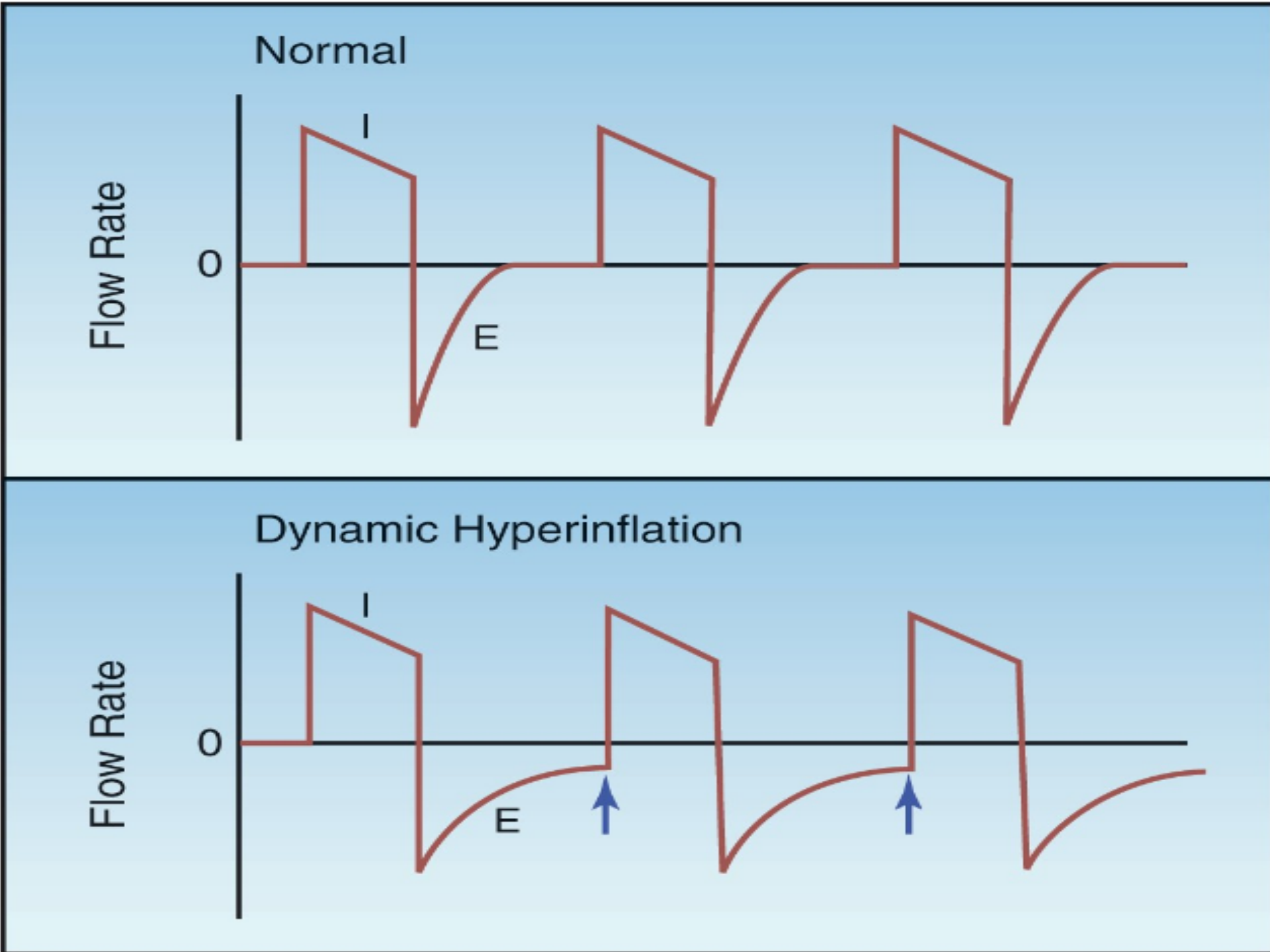

Lung Volume
(Liters)
5
4
3
2
Severe Airways
Obstruction
E
I
Intrinsic
PEEP
Normal
E
I
0
5
10
15
Transpulmonary Pressure
(cm H_20)

Inspirazione e PEEPi

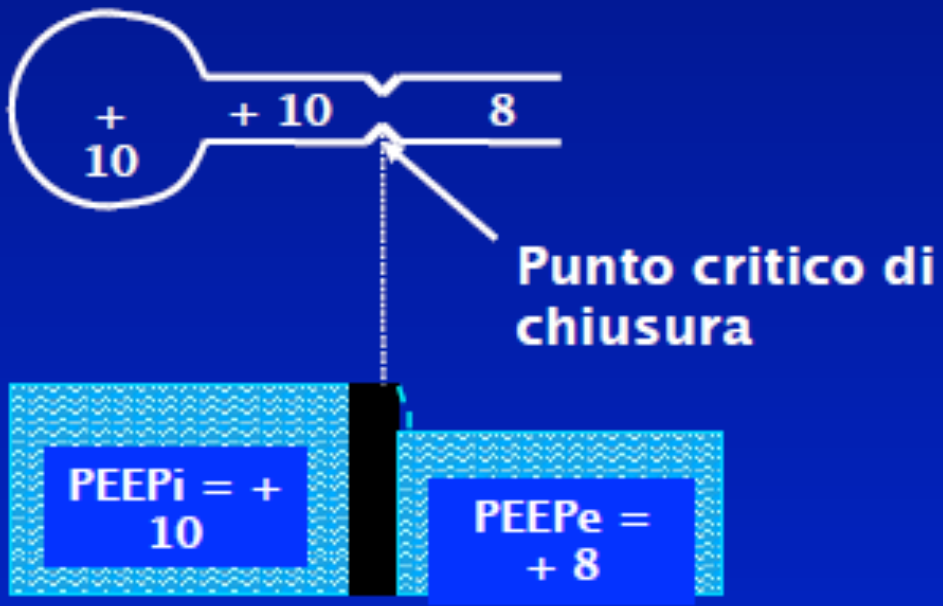




La PEEP intrinseca agisce come un carico soglia meccanico che i muscoli inspiratori devono superare prima di poter generare flusso inspiratorio, ad ogni ciclo respiratorio.


Normal
Flow Rate
O
I
E
Dynamic Hyperinflation
Flow Rate
O
I
E

PEEP intrinseca + PEEP estrinseca



Riduzione del WOB inspiratorio

Lavoro elastico (isometrico): CPAP (PEEPe) → controbilanciare la PEEPi

LAVORO RESPIRATORIO

INSPIRATORIO

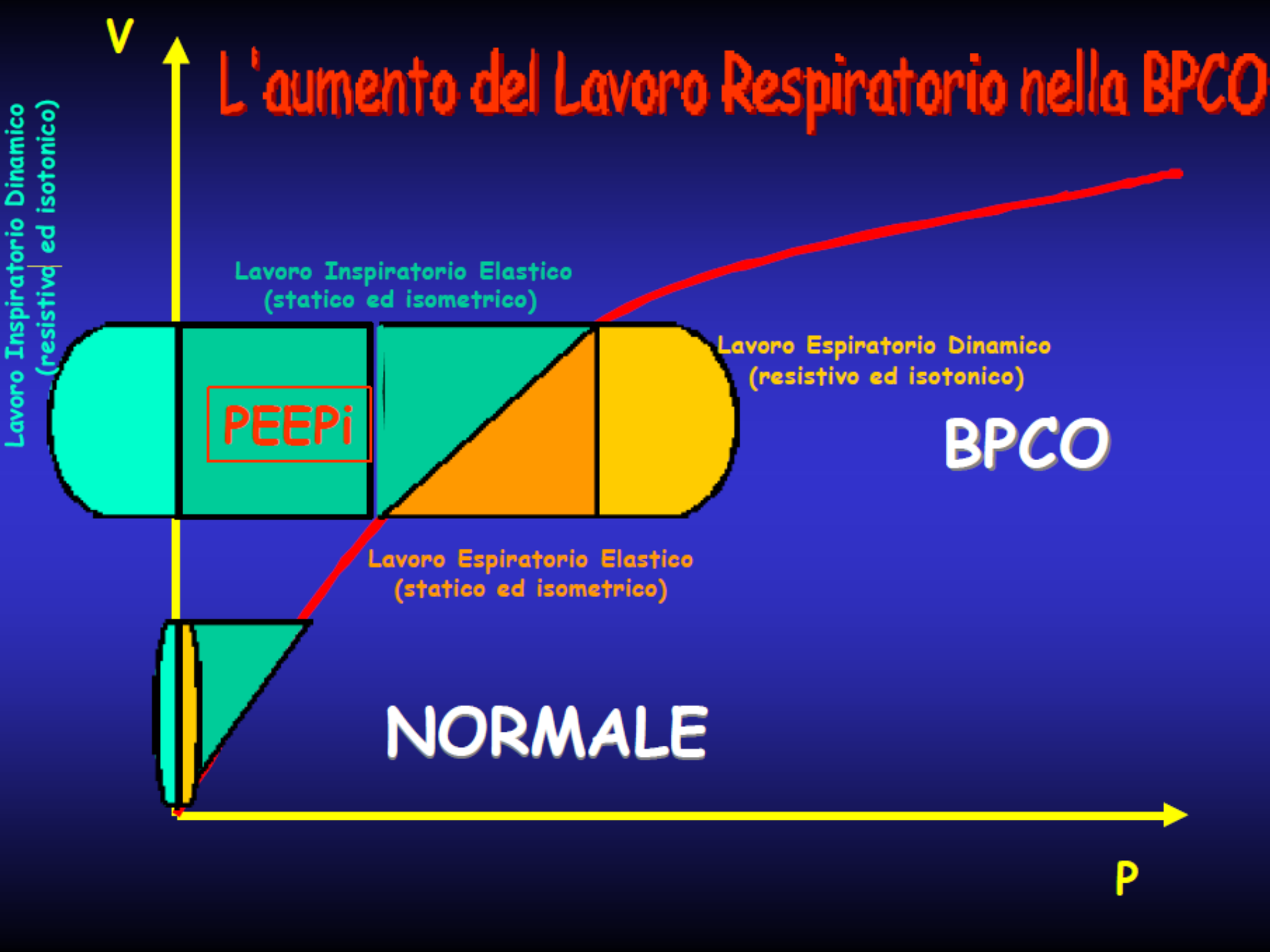
ESPIRATORIO

DINAMICO, resistivo ed isotonico

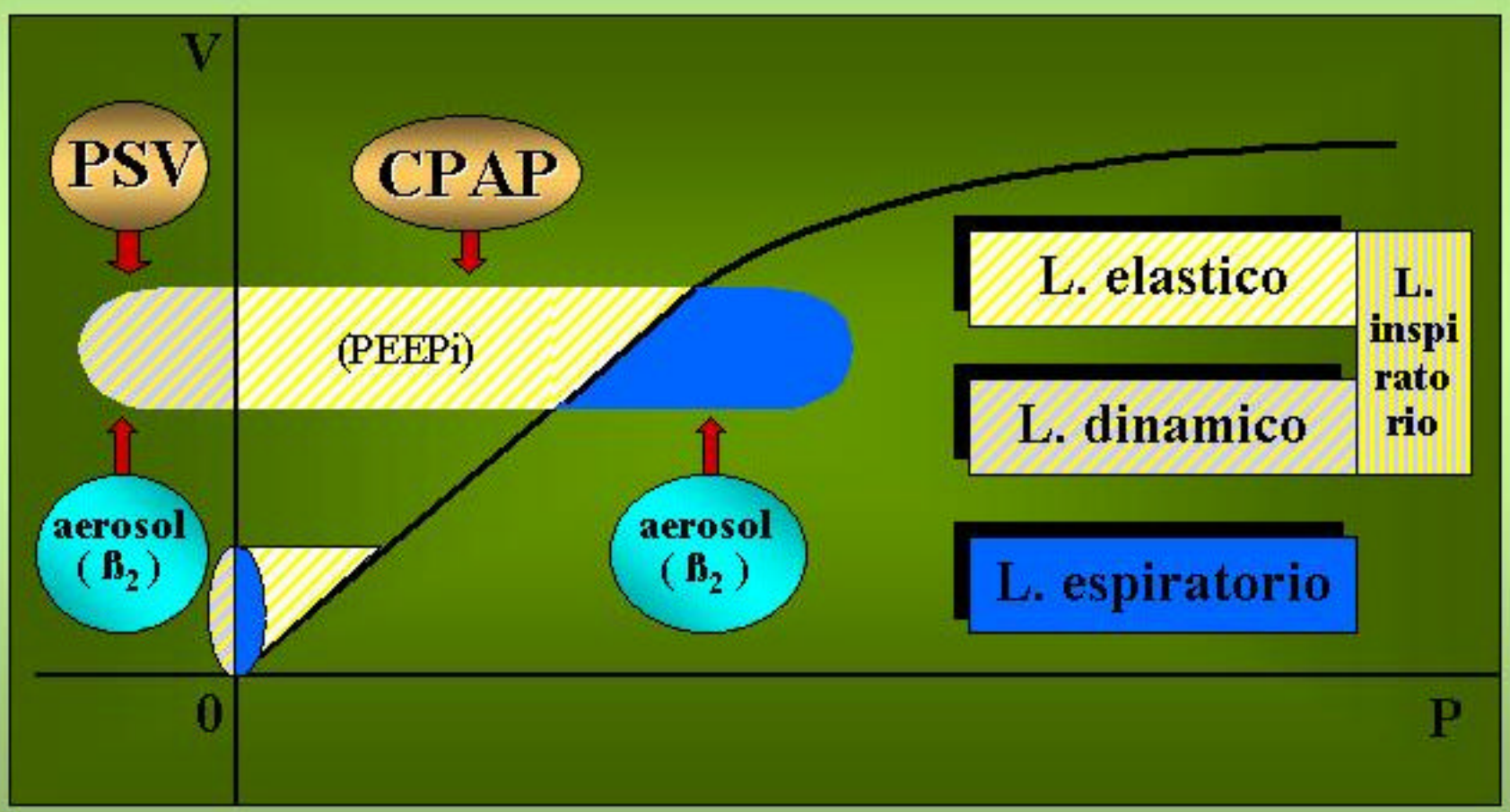
RESISTENZE AL FLUSSO DI ARIA NELLE VIE AEREE

ELASTICO, statico ed isometrico

RESISTENZE ELASTICHE DEL SISTEMA TORACO-POLMONARE


V
L'aumento del Lavoro Respiratorio nella BPCO
Lavoro Inspiratorio Dinamico
(resistivo ed isotonico)
Lavoro Inspiratorio Elastico
(statico ed isometrico)
PEEPi
Lavoro Espiratorio Dinamico
(resistivo ed isotonico)
BPCO
Lavoro Espiratorio Elastico
(statico ed isometrico)
NORMALE
P

Lavoro respiratorio nel pz. BPCO e nel soggetto sano: effetti della NIMV



Criteri di selezione per l'impiego della NIV

Indications

Bedside observations

- Increased dyspnoea—moderate to severe
- Tachypnoea (>24 breaths per min in obstructive, >30 per min in restrictive)
- Signs of increased work of breathing, accessory muscle use, and abdominal paradox

Gas exchange

- Acute or acute on chronic ventilatory failure (best indication), $PaCO_2$>45 mm Hg, pH<7·35
- Hypoxaemia (use with caution), PaO_2/F_IO_2 ratio<200

Nava S, Hill N. Non invasive ventilation in acute respiratory failure Lancet 2009, 374: 250-5

Il pH

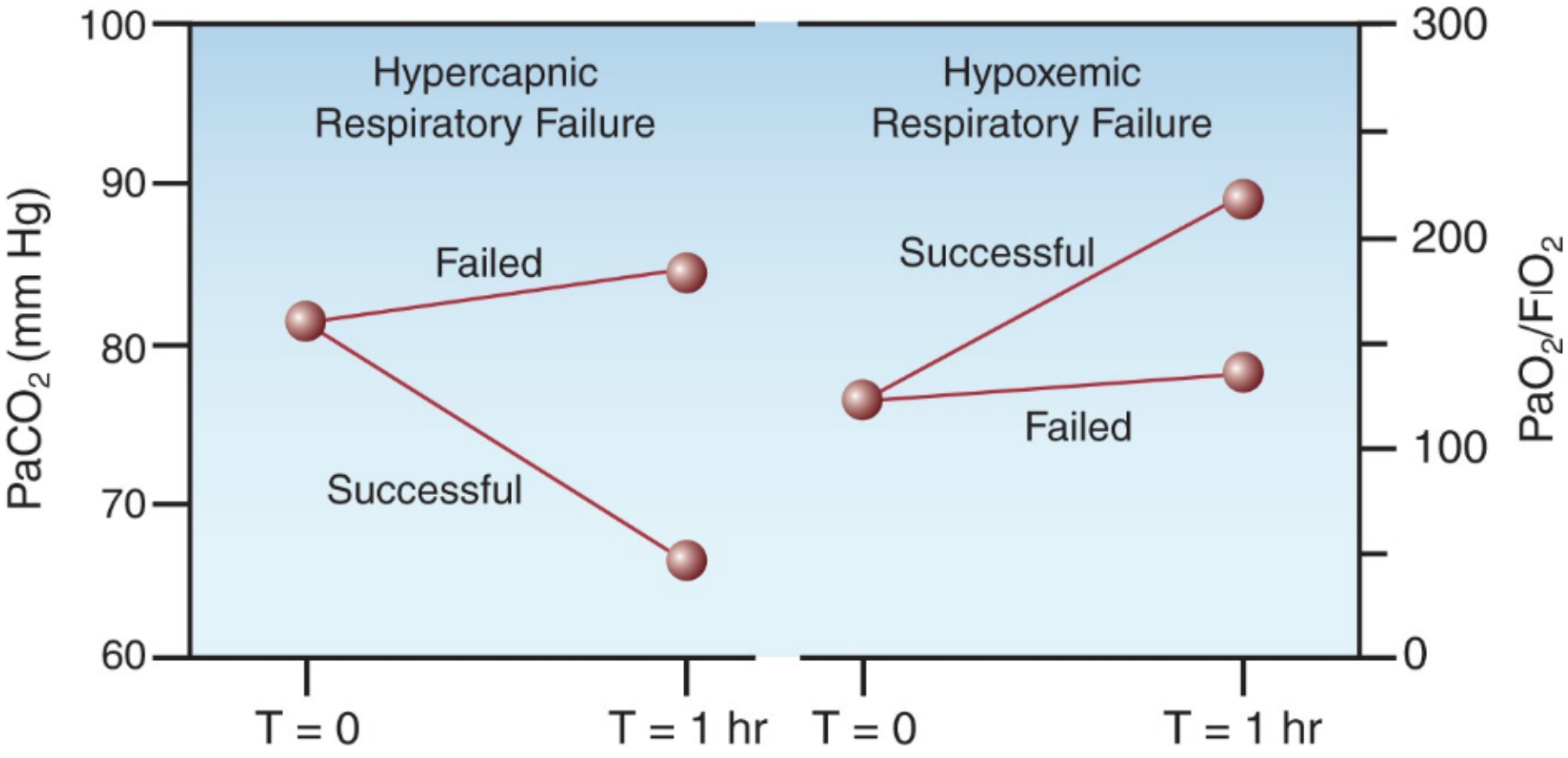
Emogasanalisi

pH < 7,20	pH < 7,30	pH < 7,35
NIV molto fortemente indicata	NIV fortemente indicata	NIV indicata
- Anche con NIV 50%→ intubazione. - Se NIV applicata con successo migliora mortalità intraospedaliera e ad 1 anno	Senza NIV 50 % peggiora sino ad intubazione o morte	- 80% migliora con terapia medica senza NIV - Per 10 pz trattati evitata 1 intubazione - Più rapida risoluzione dispnea

UTI, semi intensiva

Reparto pneumologia, medicina generale

- A condizione che: intubazione urgente disponibile; capacità personale gestione ventilatori



Antonelli et al. Int Care Med 2001; 27:1718-1728

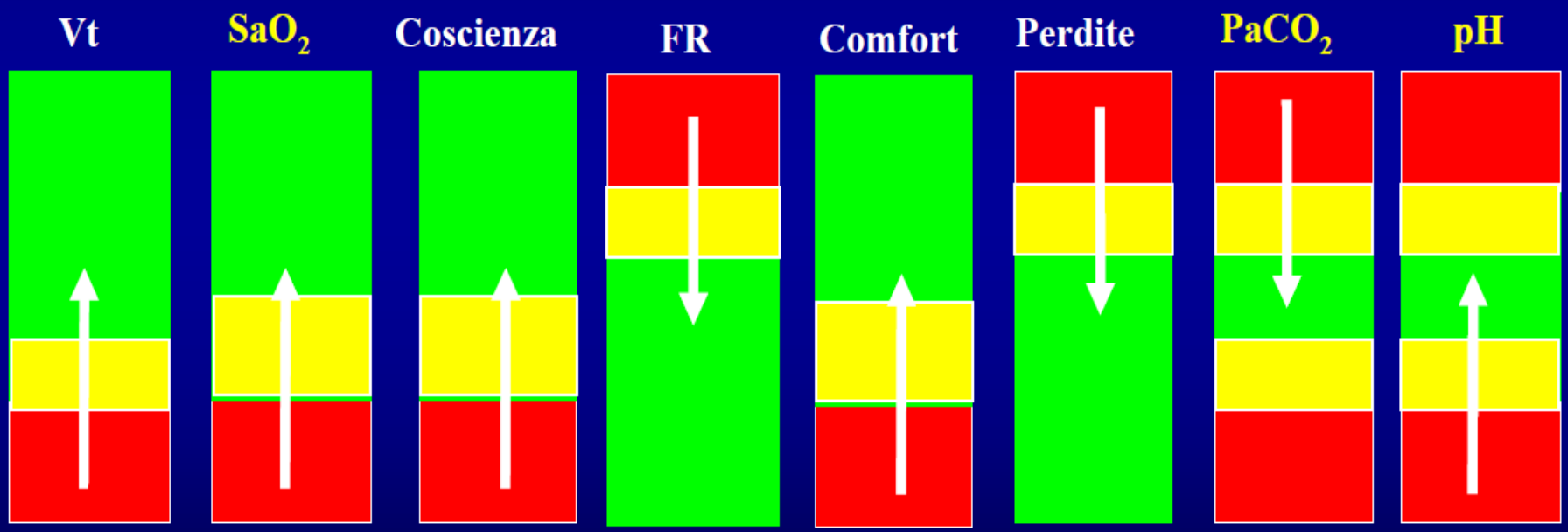
GLI OBIETTIVI

- Riduzione della dispnea
- Incremento del *comfort* del respiro
- Miglioramento della vigilanza
- Riduzione FR (20%)

- Incremento V_T (5-7 mL/kg)

- SpO_2 90-92%
- Incremento pH (< 7,35)
- Riduzione pCO_2 (15-20%)

Individua degli indicatori le cui variazioni permettono di valutare il raggiungimento o meno degli obiettivi prefissati



Movimento paradosso dell'addome, utilizzo muscolatura accessoria, P/F, PA, FC..

Where to perform noninvasive ventilation?

M.W. Elliott*, M. Confalonieri#, S. Nava¶

The ideal location for noninvasive positive-pressure ventilation will vary from country to country and indeed from hospital to hospital, depending upon local factors. However, the most important factor is that staff be adequately trained in the technique and be available throughout the 24-h period.

Eur Respir J 2002; 19: 1159–1166.

Complicanze

Iperdistensione alveolare

- ↑ V_D alveolare
- ↓ compliance polmonare
- ↑ lavoro respiratorio

Ipotensione

- ↑ Pressione intratoracica
- ↓ precarico
- Effetti emodinamici negativi sulla gittata cardiaca

Barotrauma

- Pneumotorace, pneumomediastino

con pressioni > 25 cm H_2O

Fallimento terapeutico

FATTORI DI RISCHIO

Risk stratification of NPPV failure was assessed in 1,033 consecutive patients admitted to experienced hospital units, including two intensive care units, six respiratory intermediate care units, and five general wards. NPPV was successful in 797 patients.

		pH admission <7.25		pH admission 7.25–7.29		pH admission >7.30	
	RR	APACHE ≥29	APACHE <29	APACHE ≥29	APACHE <29	APACHE ≥29	APACHE <29
GCS 15	<30	29	11	18	6	17	6
	30–34	42	18	29	11	27	10
	≥35	52	24	37	15	35	14
GCS 12–14	<30	48	22	33	13	32	12
	30–34	63	34	48	22	46	21
	≥35	71	42	57	29	55	27
GCS ≤11	<30	64	35	49	23	47	21
	30–34	76	49	64	35	62	33
	≥35	82	59	72	44	70	42

. : 0–24%; : 25–49%; : 50–74%; : 75–100%.

Eur Respir J 2005; 25: 348–355

A chart of failure risk for noninvasive ventilation in patients with COPD exacerbation

M. Confalonieri[a], G. Garuti[b], M.S. Cattaruzza[c], J.F. Osborn[c], M. Antonelli[c], G. Conti[c], M. Kodric[a], O. Resta[d], S. Marchese[e], C. Gregoretti[a,*] and A. Rossi, on behalf of the Italian noninvasive positive pressure ventilation (NPPV) study group[#,¶]

After two hours

		pH after 2 h <7.25		pH after 2 h 7.25–7.29		pH after 2 h ≥7.30	
	RR	APACHE ≥29	APACHE <29	APACHE ≥29	APACHE <29	APACHE ≥29	APACHE <29
GCS 15	<30	72	35	27	7	11	3
	30–34	88	59	49	17	25	7
	≥35	93	73	64	27	38	11
GCS 12–14	<30	84	51	41	13	19	5
	30–34	93	74	65	28	39	12
	≥35	96	84	78	42	54	20
GCS ≤11	<30	93	74	65	28	39	12
	30–34	97	88	83	51	63	26
	≥35	99	93	90	66	76	40

. : 0–24%; : 25–49%; : 50–74%; : 75–100%.

Table 27.2 Checklist for Noninvasive Ventilation

	YES	NO
A. Does the patient have:		
1. Signs of respiratory distress?	☑	☐
2. $PaO_2/FiO_2 < 200$ and/or $PaCO_2 > 45$ mm Hg?	☑	☐
B. If the answer is YES to both, answer the following questions.		
C. Does the patient have:	YES	NO
1. Respiratory failure that is an immediate threat to life?	☐	☑
2. A life-threatening circulatory disorder (e.g., shock)?	☐	☑
3. Coma, severe agitation, or uncontrolled seizures?	☐	☑
4. Inability to protect the aiways?	☐	☑
5. Hematemesis or recurrent vomiting?	☐	☑
6. Laryngeal edema, facial trauma, or recent head and neck surgery?	☐	☑
D. If the answer is NO to all of the above questions, the patient is a candidate for noninvasive ventilation.		

Marino's, The ICU Book 4 ed.

A FINAL WORD

Don't Forget to Intubate

The rising popularity of noninvasive ventilation tends to overshadow the value of endotracheal intubation. The following simple rules about endotracheal intubation deserve mention.

Rule 1: **Hesitation invites trouble.** There is a tendency to rely on noninvasive ventilation and delay intubation as long as possible in the hopes that it will be unnecessary. However, delays in intubation create unnecessary dangers for the patient because emergency intubations in patients who are *in extremis* can be troublesome as well as dangerous. As soon as intubation becomes a serious consideration, you should intubate the patient and get control of the airway without delay.

Rule 2: **Endotracheal intubation is not the 'kiss of death'.** The perception that "once on a ventilator, always on a ventilator" is a fallacy that should never influence the decision to intubate a patient for full ventilatory support. Being on a ventilator does not create ventilator dependence, having a severe cardiopulmonary or neuromuscular disease does.

Marino's, The ICU Book 4 ed.


Qlink