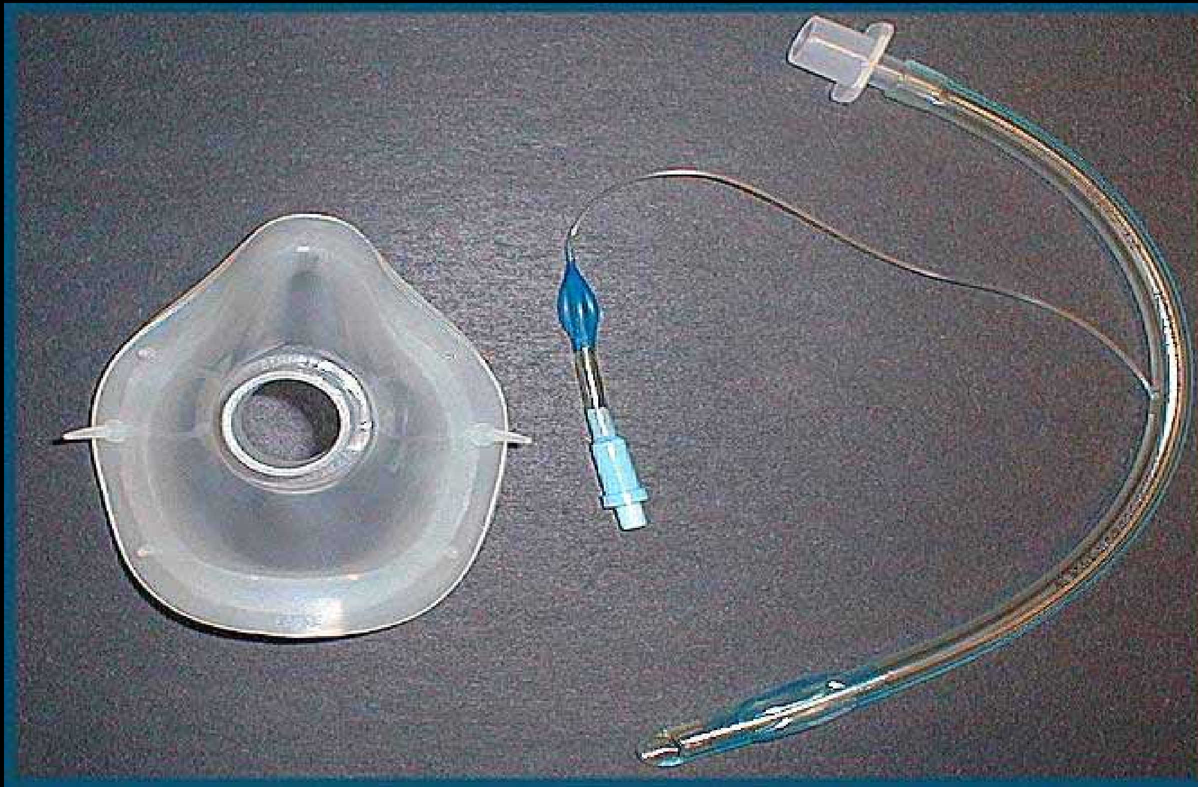
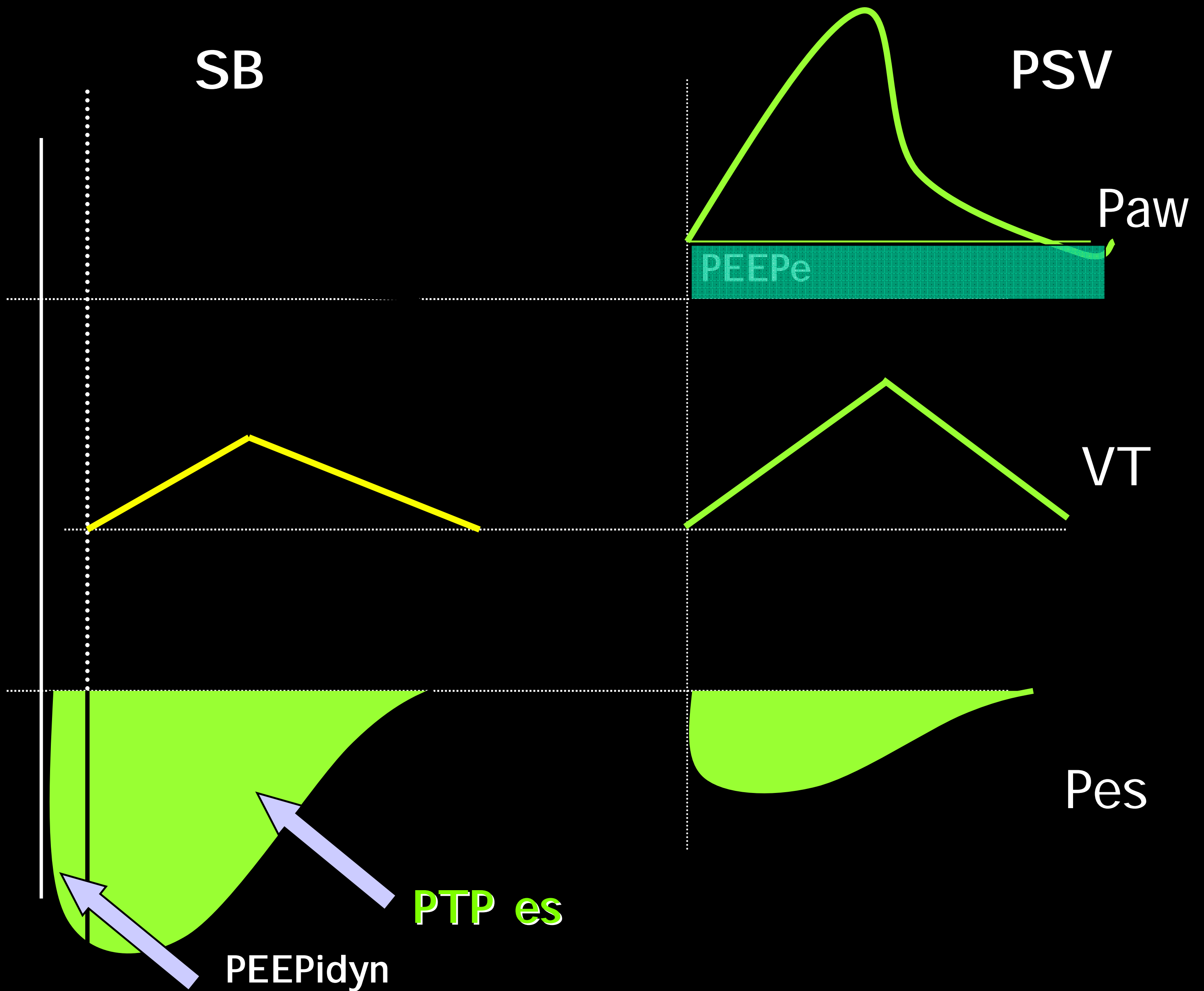
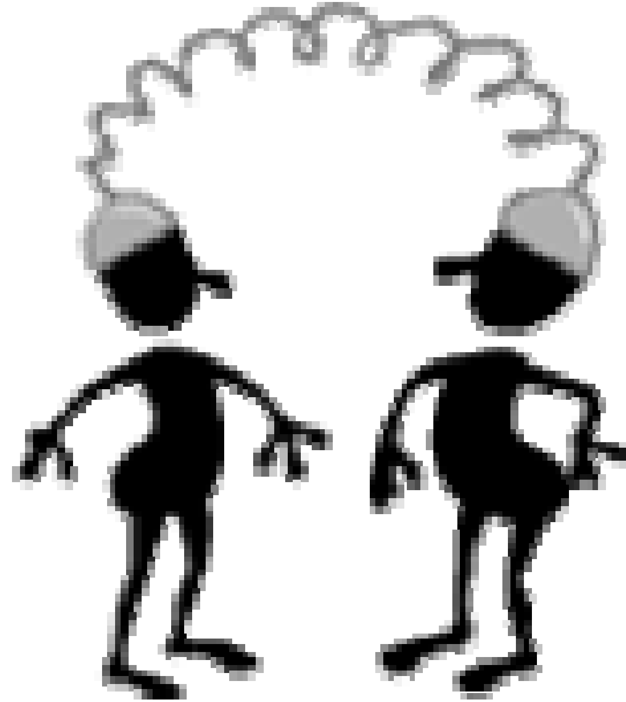


La ventilazione invasiva e non invasiva:

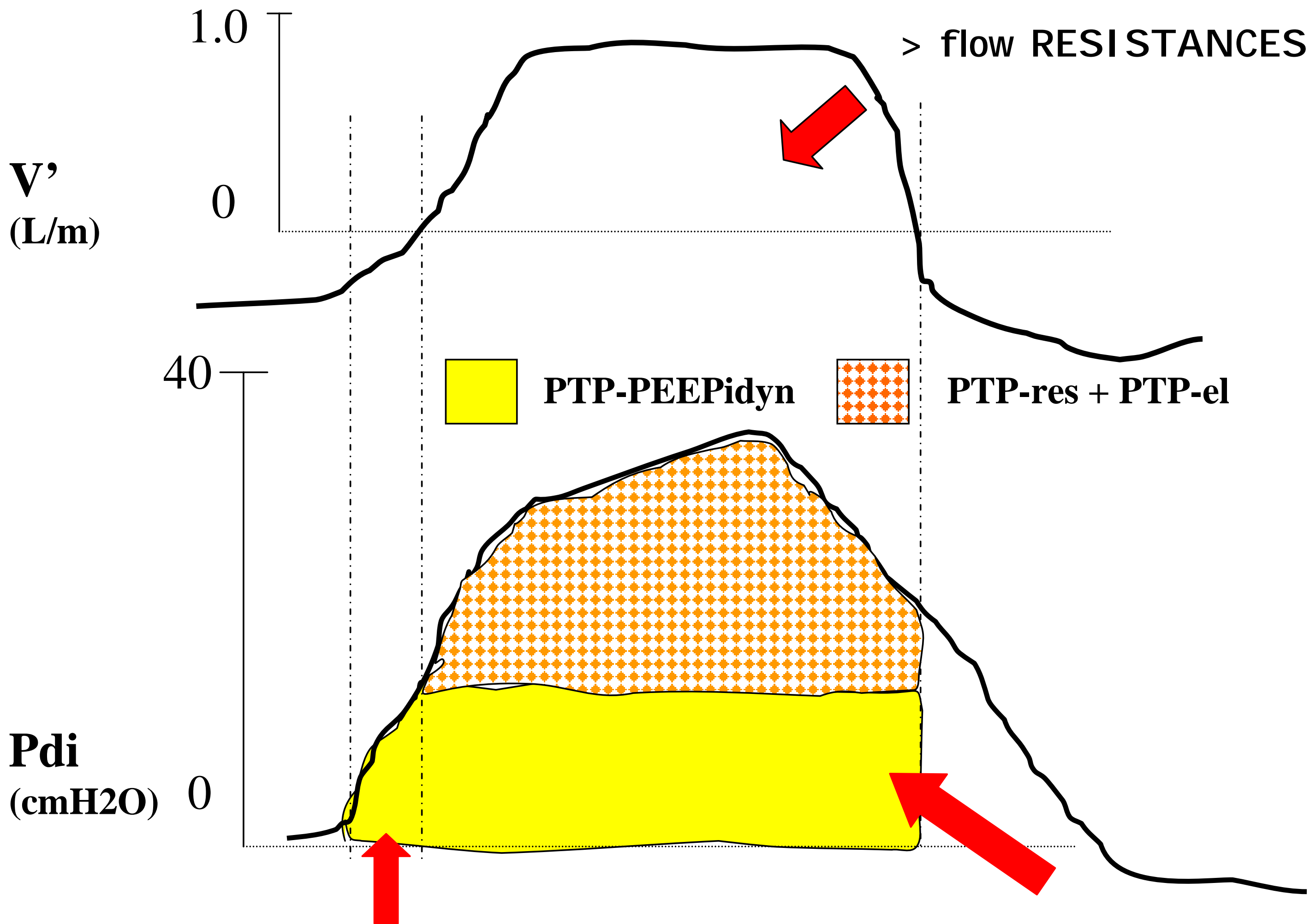
protocolli di svezzamento dalla protesi meccanica

Michele Vitacca
Divisione di Pneumologia, centro svezzamento prolungato
FSM Gussago/Lumezzane (BS)


SB
PSV
Paw
PEEPe
VT
Pes
PTP es
PEEPidyn



interazione uomo macchina



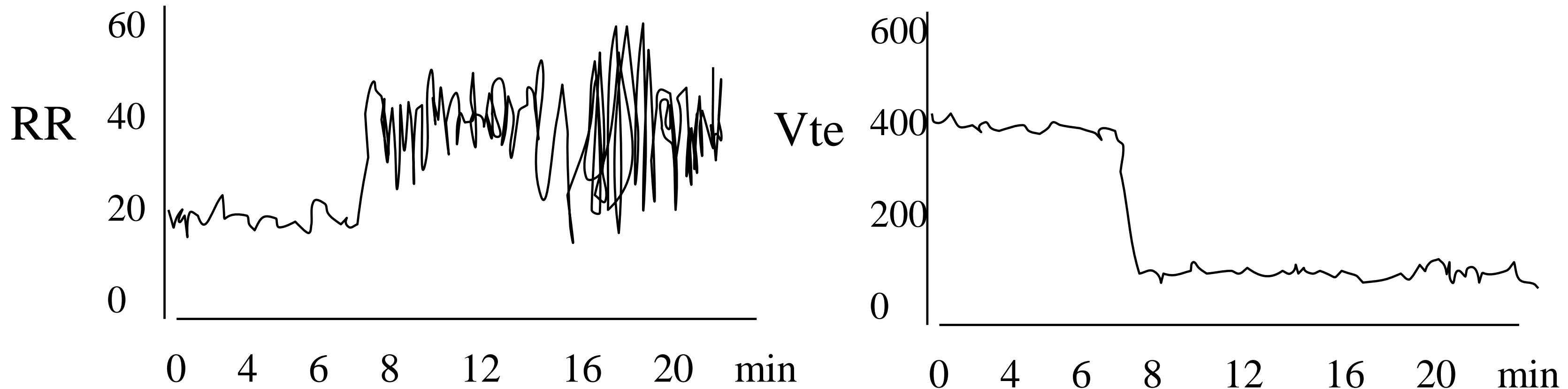
HYPERINFLATION (High PEEPi-dyn),

excessive loading

COPD

> 40%

Respiro rapido e superficiale



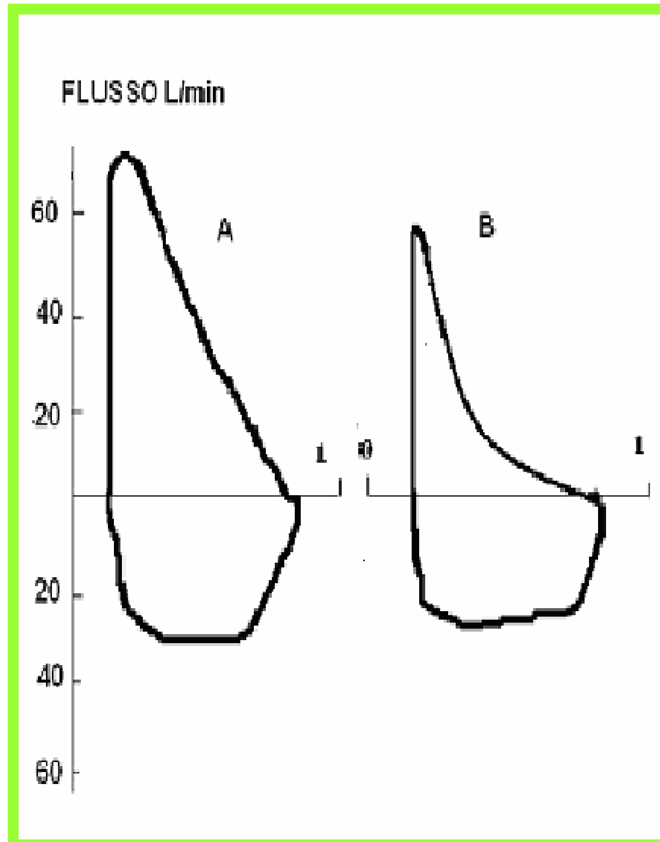
F x Vte = VE

Tobin MJ, et al. Am Rev Respir Dis 1986; 134: 1111-8

Inhaled Fenoterol–Ipratropium Bromide in Mechanically Ventilated Patients with Chronic Obstructive Pulmonary Disease

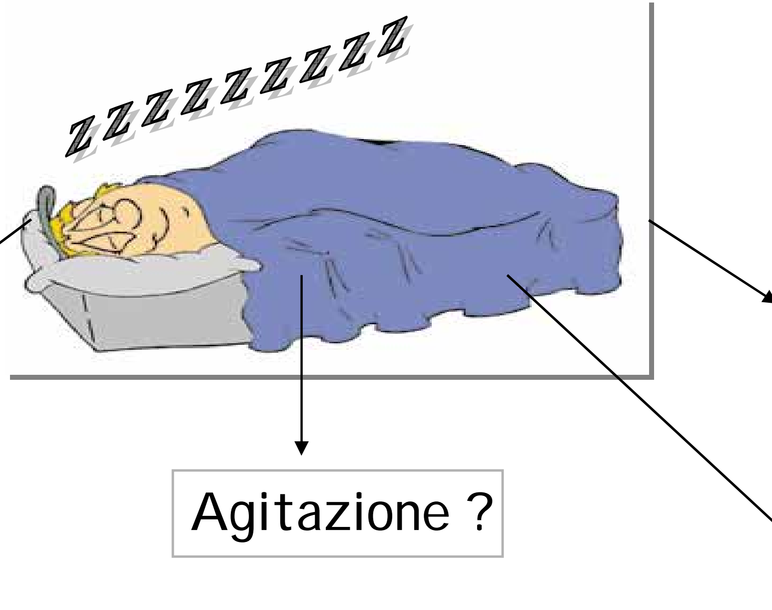
CLAUDE GUERIN, ARNAUD CHEVRE, PIERRE DESSIRIER, THIERRY PONCET, MARIE-HELENE BECQUEMIN, PIERRE FRANÇOIS DEQUIN, CHANTAL LE GUELLEC, DIDIER JACQUES, and GERARD FOURNIER

AM J RESPIR CRIT CARE MED 1999;159:1036–1042.



Bronco-ostruzione

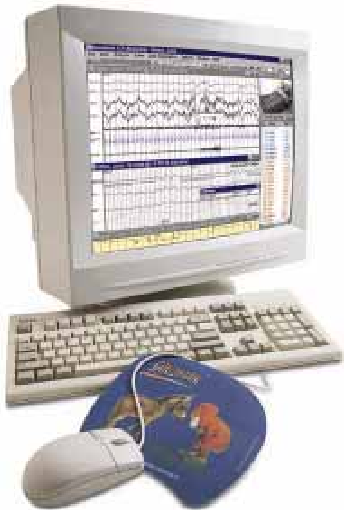
Ritmo sonno/veglia

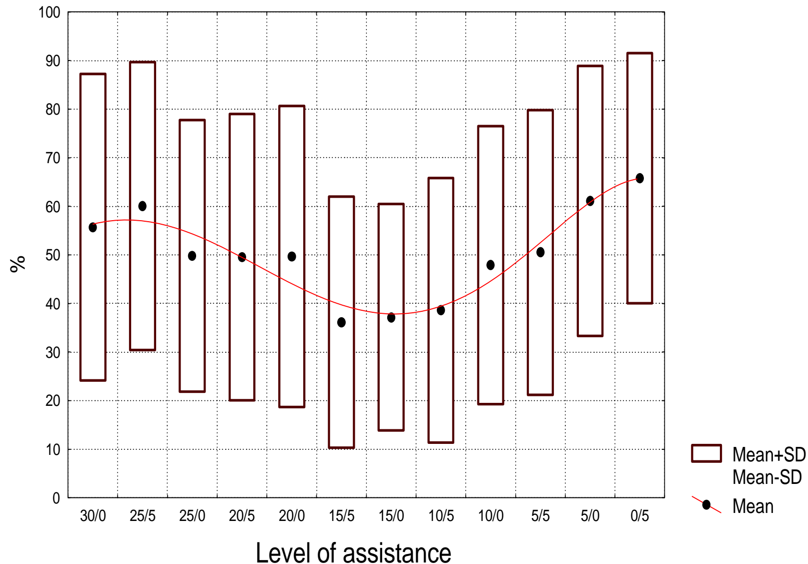


Apnee ?

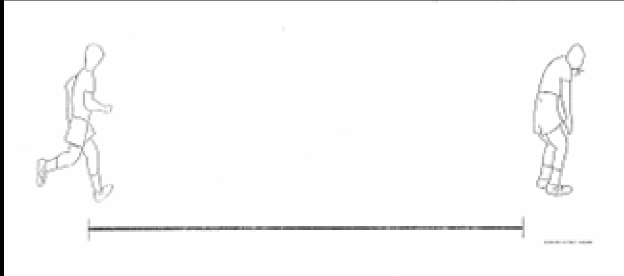
Agitazione ?

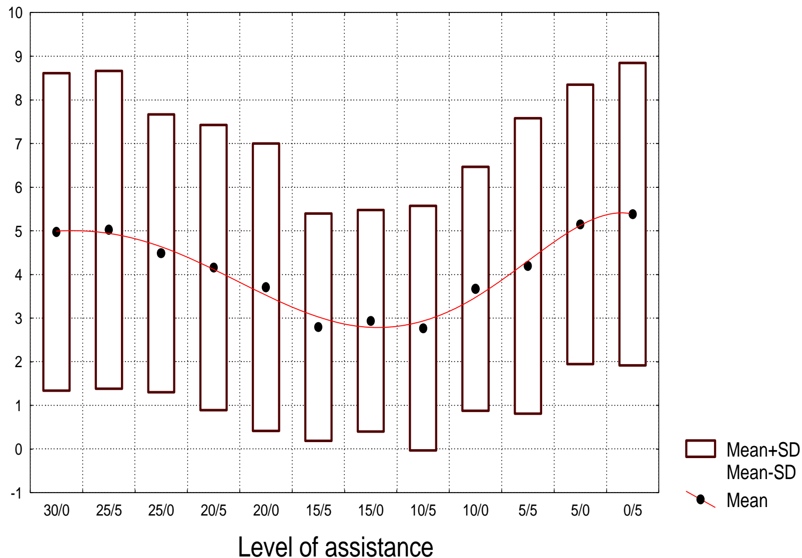
Movimenti incontrollati
e rischio di cadute ?





comfort



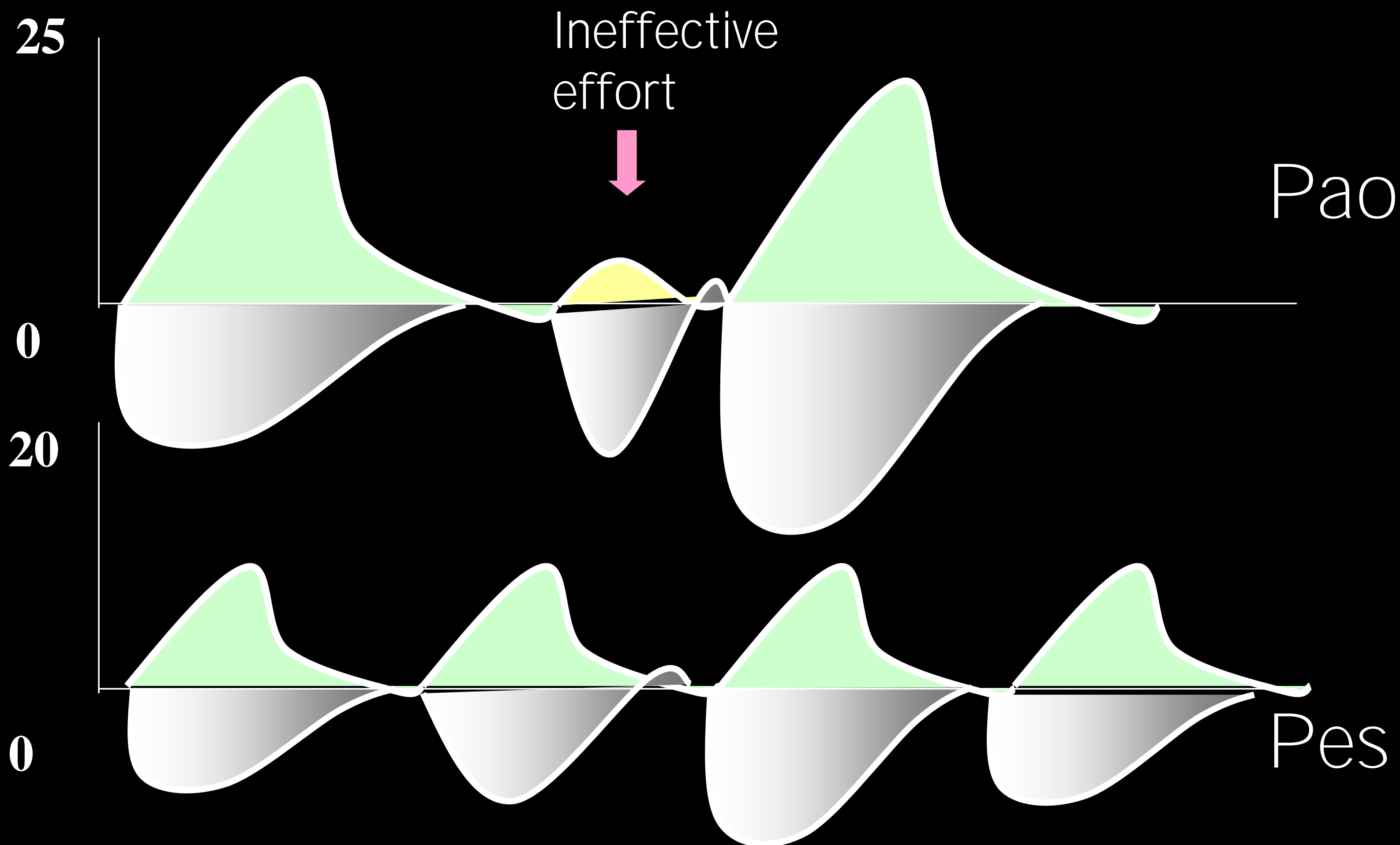


BORG SCALE

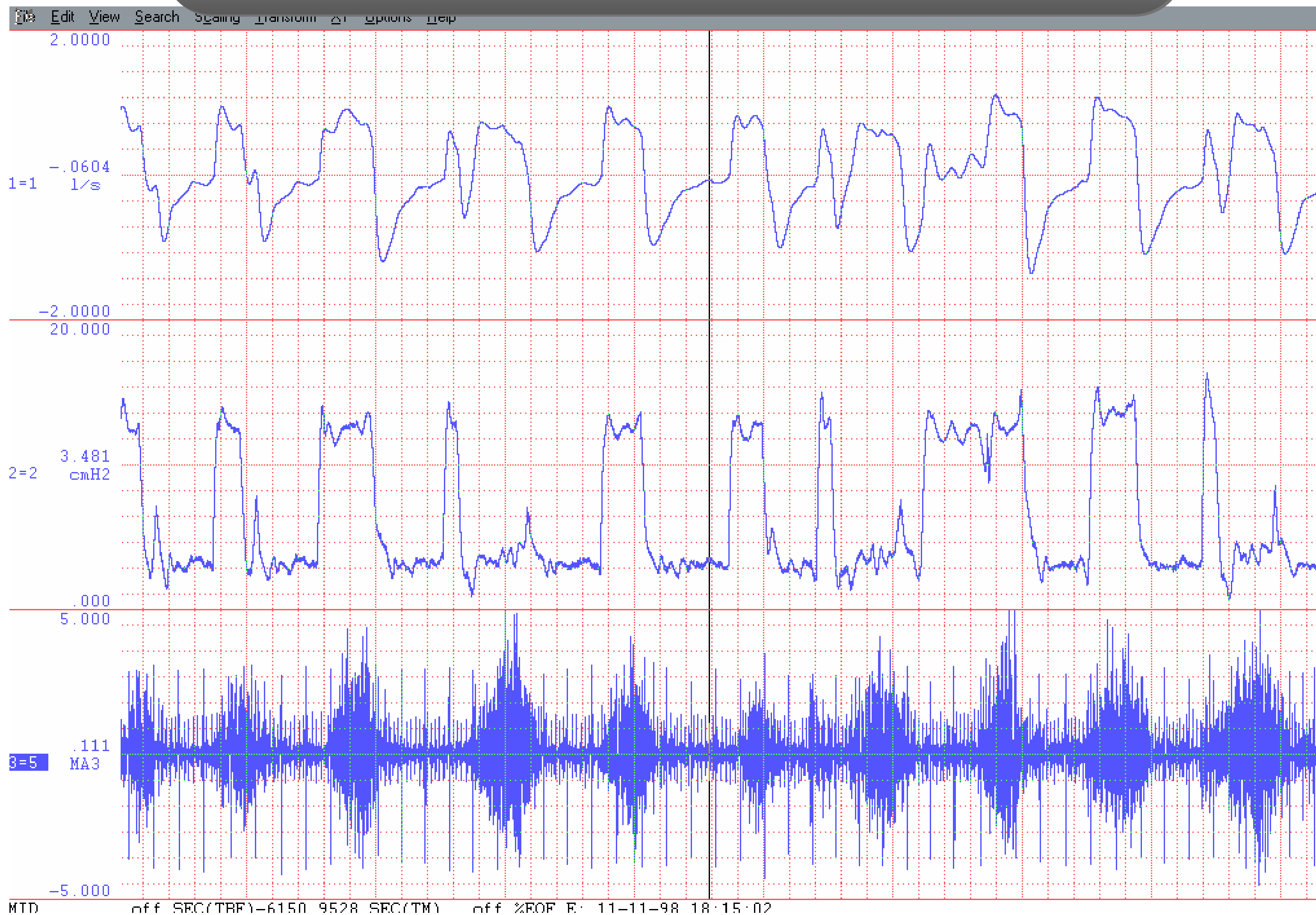
- 0 assolutamente nulla
- 0.5 molto, molto lieve
- 1 molto lieve
- 2 lieve
- 3 media
- 4 a volte severa
- 5 severa
- 6
- 7 molto severa
- 8
- 9 molto molto severa
- 10 massima

M. Vitacca Chest 2004

Sforzi inefficaci

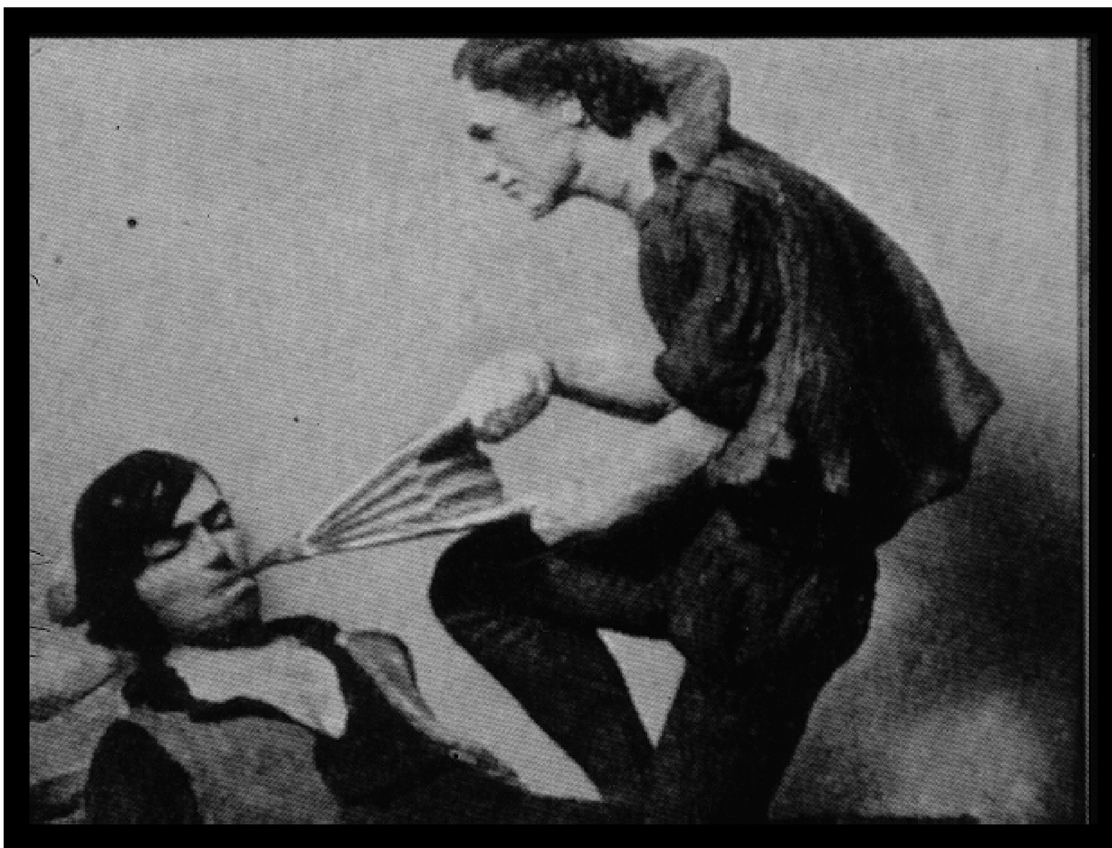


Totale desincronizzazione durante PSV



Con la cortesia del dott. Polese

La ventilazione non invasiva



BTS Guideline of NIMV in ARF Thorax 2002; 57: 192-211

INDICATIONS for STARTING NIV in ARF

RR > 25-35 b/m and SEVERE DYSPNOEA

$SaO_2 \leq$ 88% while breathing O_2 (FiO_2>35%);

Low A-a oxygen gradient; PaO2/FiO2 < 200

SUDDEN ICREASE IN $PaCO_2$ ($\geq$15mmHg);

PaCO2 > 6.0 Kpa

pH < 7.35/7.34 (sudden decrease)

RESPIRATORY DISTRESS:

- cyanosis
- paradoxical movements
- recruitment accessory muscles

SENSORIUM IMPAIRMENT: sick but not moribund (excluding coma ?); able to protect airway; cooperative

Consensus Conferences Am J Respir Crit Care Med 2001

Contraindications to NIV

- Cardiac or respiratory arrest
- Nonrespiratory organ failure
  - severe encephalophaty (GCS <10)
  - severe upper gastrointestinal bleeding
  - haemodynamic instability or unstable cardiac arrhythmia
- Facial surgery, trauma or deformity
- Upper airway obstruction
- Inability to cooperate/protect the airway
- Inability to clear respiratory secretions
- High risk for aspiration

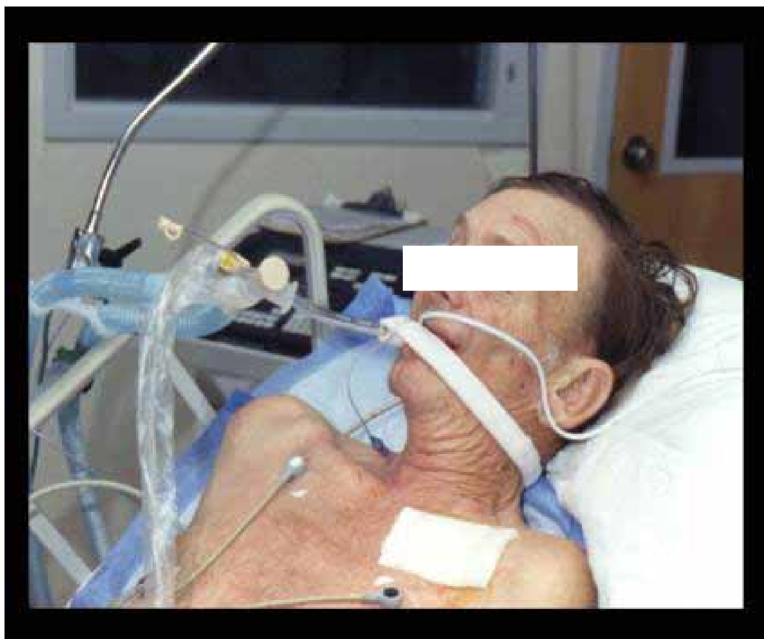
BTS Guideline of NIMV in ARF   Thorax 2002; 57: 192-211

Indications and diseases

• NIV before EI or **who are not candidate (DNR)**	(D)
• exacerb. of **COPD** (ph <7.35) despite optimal MT	(A)
• CPAP in **CPE** despite hypoxia during MT; 2° choise NIV	(B)
• NIV in acute exacerb. in **restrictive** disease	(C)
• CPAP or NIV for decompensated **OSA**; NIV if acidosis	(C)
• CPAP in hypoxic **chest wall trauma**	(C)
• NIV should not be used routinely in CWT;	(D)
• it needs ICU monitoring	(D)
• NIV or CPAP for hypoxic patients **(pneumonia)** in HDU or ICU	(D)
• NIV as alternative to EI if pneumonia pts became hypercapnic	(C)
• NIV should not be used raoutinely in acute **asthma**	(C)
• NIV in exacerb. of **bronchiectasis** (ph<7.35)	(C)
• NIV in **ARDS**, **post operative**, **post transplantation** ARF	(D)
• NIV for weaning from EI	(B)

Ph: <7.35 risk of hypoxia	Preventive application	GW/HDU/ICU/ER
Ph: <7.30 or PaO2/FiO2 < 200 Severe distress	Curative application as EI	HDU/ICU/ER
No limits	Instead of EI	HDU/ICU
Consciusness ph stability	Weaning method	HDU/ICU
Patients at risk of ARF	Post extubation failure	GW/HDU/ICU

La ventilazione invasiva



La strategia è di gruppo

paziente

ambiente

famiglia

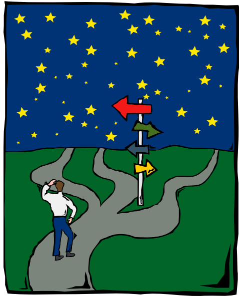
fisioterapisti

medici

infermieri

Hanno un ruolo i protocolli dedicati allo svezzamento ?

Weaning approach remains debated and related to great subjective decisions !
Rarely too early, often too late



PROTOCOL:
PROTOS + KOLLAN: To glue together !!!!

Literature

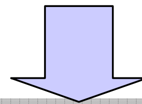
Patient′ point of view

Feed-back

Expert consensus

experiance

guide lines

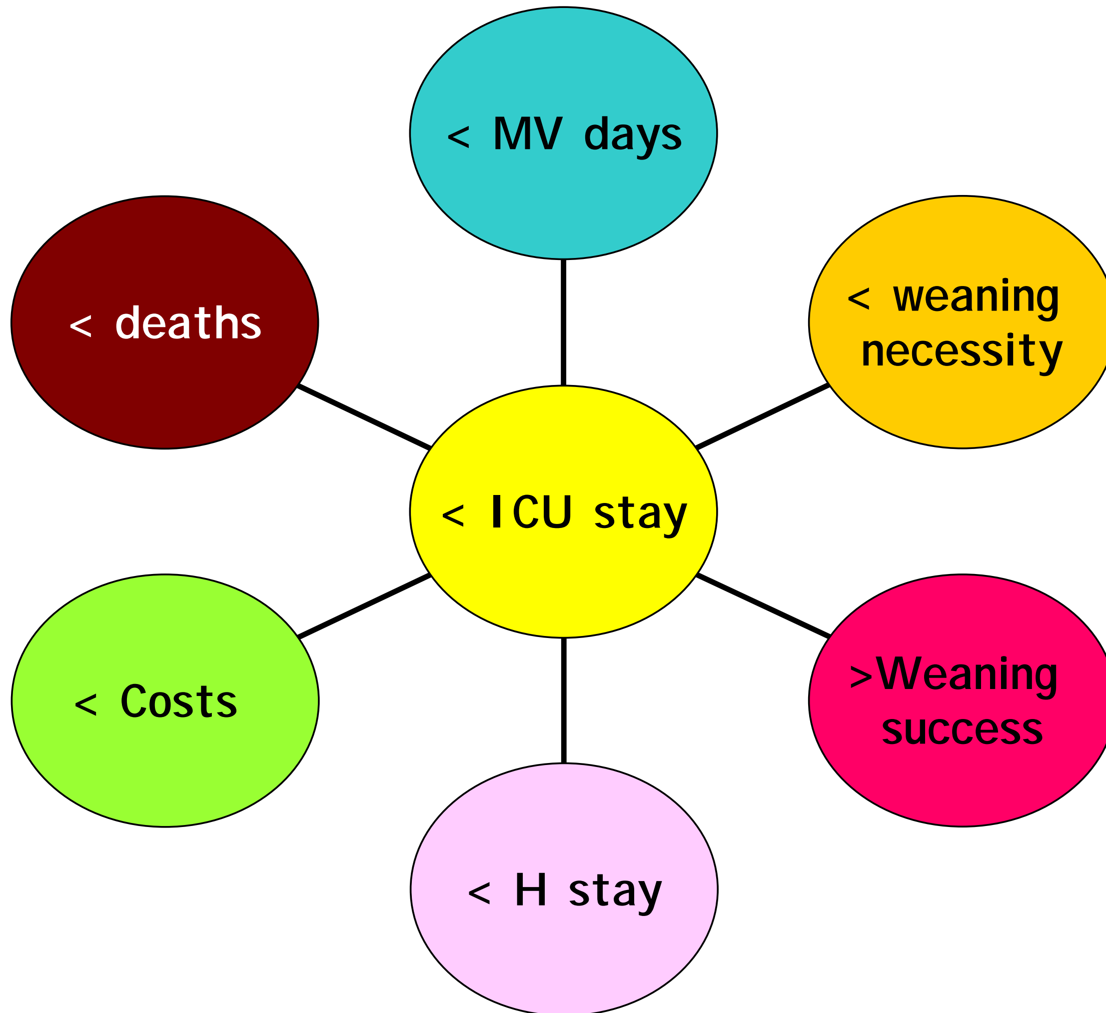


Consensus, standardized care plan, flow chart
according to objective measurable variables, rigid items, questions and end points
To allocate a performance and to reduce time spent for it.

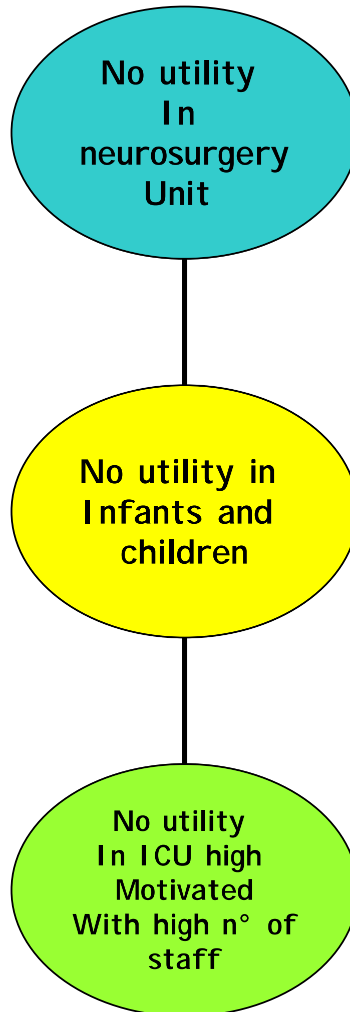
Clinical results with a WP:

from 1995-2005 Medline research:
protocols during weaning=163 studies

Positive results from literature



Negative results from literature



The New England Journal of Medicine

EFFECT ON THE DURATION OF MECHANICAL VENTILATION OF IDENTIFYING PATIENTS CAPABLE OF BREATHING SPONTANEOUSLY

E. Wesley Ely, M.D., M.P.H., Albert M. Baker, M.D., Donnie P. Dunagan, M.D., Henry L. Burke, M.D., Allen C. Smith, M.D., Patrick T. Kelly, M.D., Margaret M. Johnson, M.D., Rick W. Browder, M.D., David L. Bowton, M.D., and Edward F. Haponik, M.D.

(1996; 335:1864-9.)

Treated group was a strategy of combined management:
•daily screening of respiratory function
•a trial of SB
•notification to physician of successful results.

Only pts who passed a screening test underwent a trial of SB.

Vs

Controls:
• were screened daily,
• did not undergo trials of SB or have any feedback from personnel.
• All decisions about weaning, the discontinuation of MV, discharge from ICU and H were made by the patients' attending physicians.

Neither the mode of ventilation nor the weaning strategy used by the attending physicians was specified.

EFFECT ON THE DURATION OF MECHANICAL VENTILATION OF IDENTIFYING PATIENTS CAPABLE OF BREATHING SPONTANEOUSLY

E. Wesley Ely, M.D., M.P.H., Albert M. Baker, M.D., Donnie P. Dunagan, M.D., Henry L. Burke, M.D.,
Allen C. Smith, M.D., Patrick T. Kelly, M.D., Margaret M. Johnson, M.D., Rick W. Browder, M.D.,
David L. Bowton, M.D., and Edward F. Haponik, M.D.

(1996; 335:1864-9.)

Characteristic	Intervention Group (N=149)	Control Group (N=151)
Male sex — no. (%)	67 (45)	84 (56)
Treatment in coronary care unit — no. (%)	33 (22)	29 (19)
Age — yr	61.7±15.8	60.5±15.5
APACHE II score	19.8±6.0	17.9±6.2
Acute-lung-injury score	1.9±0.8	1.7±0.8
Median duration of respiratory failure — days†	3.0	2.0
Mode of ventilation — no. of patients (%)		
Intermittent mandatory ventilation	42 (28)	50 (33)
Pressure-support ventilation	26 (17)	19 (13)
Both	64 (43)	65 (43)
Pressure-control ventilation	3 (2)	5 (3)
Assist–control ventilation	6 (4)	4 (3)
Continuous positive airway pressure	8 (5)	8 (5)

Daily screening of respiratory function and trials of SBT

% of pts on MV

100
90
80
70
60
50
40
30
20
10
0

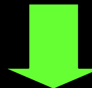
0 1 3 5 15 25

Days

control (151 pts)

intervention (149 pts)

Ely N. Engl J Med 1996



Self extubation, reintubation, tracheostomy, ICU costs

The New England Journal of Medicine

EFFECT ON THE DURATION OF MECHANICAL VENTILATION OF IDENTIFYING PATIENTS CAPABLE OF BREATHING SPONTANEOUSLY

E. Wesley Ely, M.D., M.P.H., Albert M. Baker, M.D., Donnie P. Dunagan, M.D., Henry L. Burke, M.D., Allen C. Smith, M.D., Patrick T. Kelly, M.D., Margaret M. Johnson, M.D., Rick W. Browder, M.D., David L. Bowton, M.D., and Edward F. Haponik, M.D.

(1996; 335:1864-9.)

Our observations also underscore the key role of nonphysician health professionals in providing safe, efficient ventilatory care. During the study, the commitment of time by physicians appeared minimal, since most monitoring was done by respiratory therapists and nurses as part of their standard patient care.

A Prospective, Controlled Trial of a Protocol-based Strategy to Discontinue Mechanical Ventilation

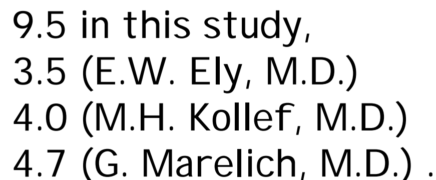
Jerry A. Krishnan, Dana Moore, Carey Robeson, Cynthia S. Rand, and Henry E. Fessler

Department of Medicine; and Department of Medical Nursing, Division of Pulmonary and Critical Care Medicine, Johns Hopkins Medical Institutions, Baltimore, Maryland

Am J Respir Crit Care Med Vol 169. pp 673–678, 2004

Patients randomized to Usual Care (doctors) vs Ely protocol (RT):

- Discontinuation of MV was left entirely to the discretion of the physicians
- No scheduled screening was performed by ancillary staff,
- An f/Vt determination could be requested or measured by the attending at the bedside.
- Physicians specified each ventilator setting or the beginning and end of a SBT with an individual order.
- Printed rounding template at bedside



Physician-hours/bed/day:

9.5 in this study,
3.5 (E.W. Ely, M.D.)
4.0 (M.H. Kollef, M.D.)
4.7 (G. Marelich, M.D.) .

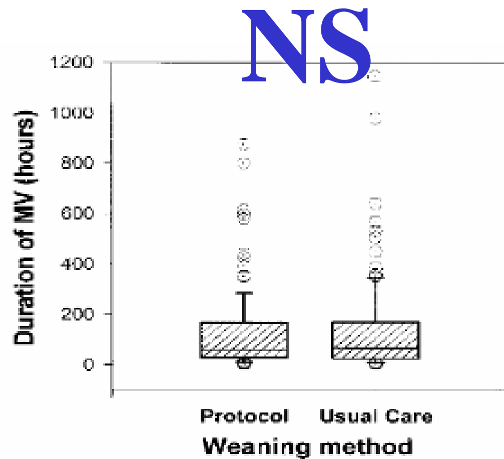
A Prospective, Controlled Trial of a Protocol-based Strategy to Discontinue Mechanical Ventilation

Jerry A. Krishnan, Dana Moore, Carey Robeson, Cynthia S. Rand, and Henry E. Fessler

Department of Medicine; and Department of Medical Nursing, Division of Pulmonary and Critical Care Medicine, Johns Hopkins Medical Institutions, Baltimore, Maryland

Am J Respir Crit Care Med Vol 169. pp 673–678, 2004

NS



- reinstitution of MV
- ICU stay
- H deaths

were similar in group treated with a WP vs controls

Weaning time less than 3 days

TABLE 3. SECONDARY OUTCOMES BY GROUP

Outcome	Group		p Value
	PW	UC	
Duration of SBT, hr, median (IQR)	3.0 (1.3–5.6)	1.6 (0–3.9)	< 0.01

A Prospective, Controlled Trial of a Protocol-based Strategy to Discontinue Mechanical Ventilation

Jerry A. Krishnan, Dana Moore, Carey Robeson, Cynthia S. Rand, and Henry E. Fessler

Department of Medicine; and Department of Medical Nursing, Division of Pulmonary and Critical Care Medicine, Johns Hopkins Medical Institutions, Baltimore, Maryland

Am J Respir Crit Care Med Vol 169. pp 673–678, 2004

Weaning by nursing and respiratory therapy according to a protocol did not reduce duration of MV, length of stay, or mortality compared with weaning by physicians.

Lack of benefit:

- the high levels of physician staffing with interest for weaning (costs/benefits analysis ?)
- the use of a template on rounds to promote daily discussion of mechanical ventilation (protocol ?)

WHO performs a WP ?

Habits and organisations are different

nurse

therapist

others

Doctor (intensivist weaning spec. pulmonologist)

WHO performs a WP ?

Probably
a team
is better !

How is conducted a WP:
daily screening of respiratory function

The day after

Pt presents:

VE ≤15 L/min; FiO_2 ≤ 60%;
PEEP ≤ 10 cmH_20
Good neurological status

NO

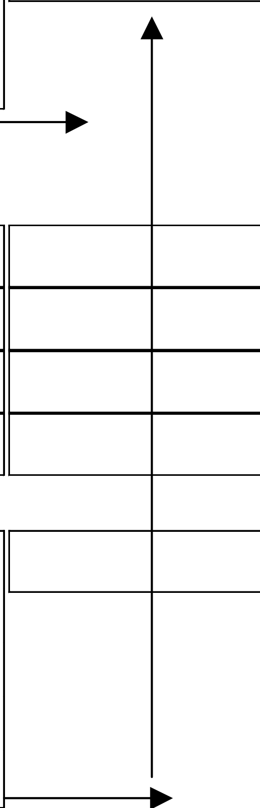
Yes

Start with **assisted ventilation**

Pt presents ?

VE < 15 L/min; FiO_2 ≤40 %; PEEP ≤6
PaO_2/FiO_2 ≥200; f/VT ≤105; MIP ≥20
FC < 140 b/m; f < 25 R/m;
pH > 7.35; sistolic pressure > 100 e < 150;
Sat O2 > 90 %; cough ;
Good neurological status;
no agitation; no sedatives;

NO



Sequential diagnostic test during weaning (MJ Tobin ICC 2005)

Probability of weaning success

Probability of extubation success

Perform as soon as possible the spontaneous breathing trial !

Repeat every day the spontaneous breathing trial !

Yes

↓

SBT test

↓

Patient presents distress signs ?

***f* > 35 a/min; SatO2 < 90% ($FiO_2 \geq 40\%$)**
FC > 145 b/m or increse /decrease HR more than 20%; arrytmia;
sistolic pressure > 180 o < 70 mm Hg;
agitation; anxious ; diaphoresis

NO →

Patient' extubation or stop to MV if tracheotomized

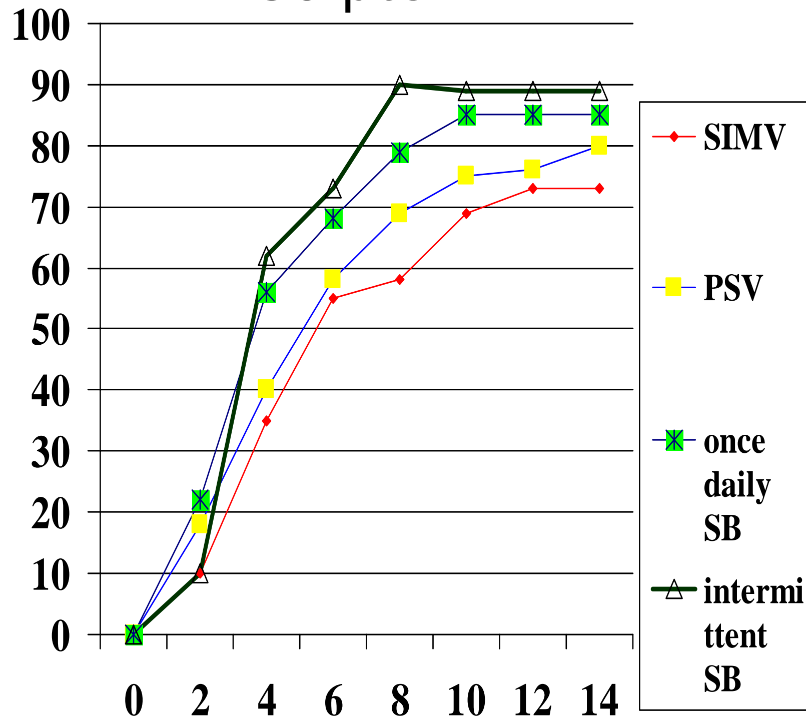
Yes

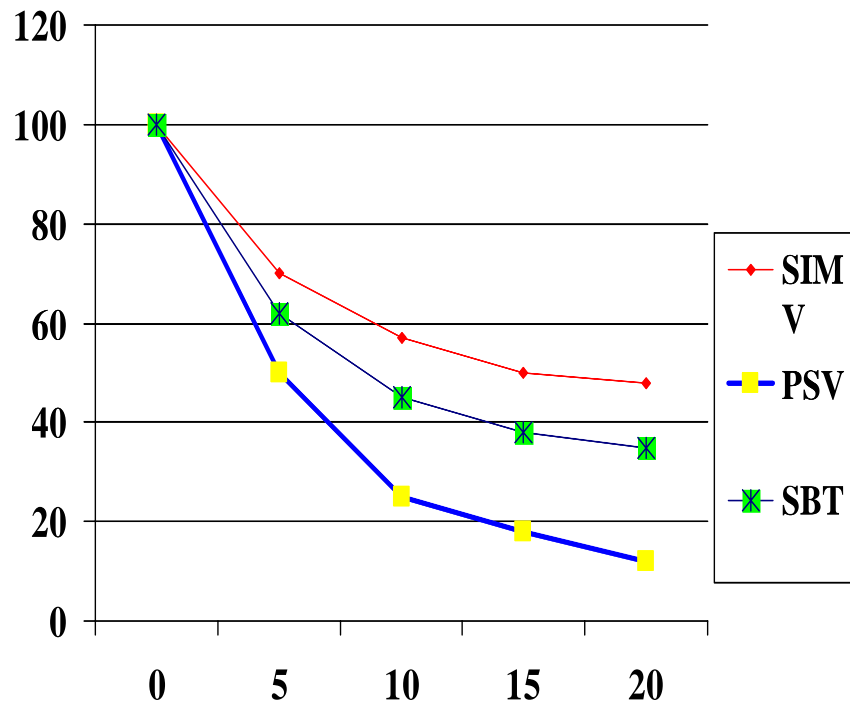
↓

Patient is submitted to MV.

Then it starts prolonged weaning protocol

Weaning MV modalities



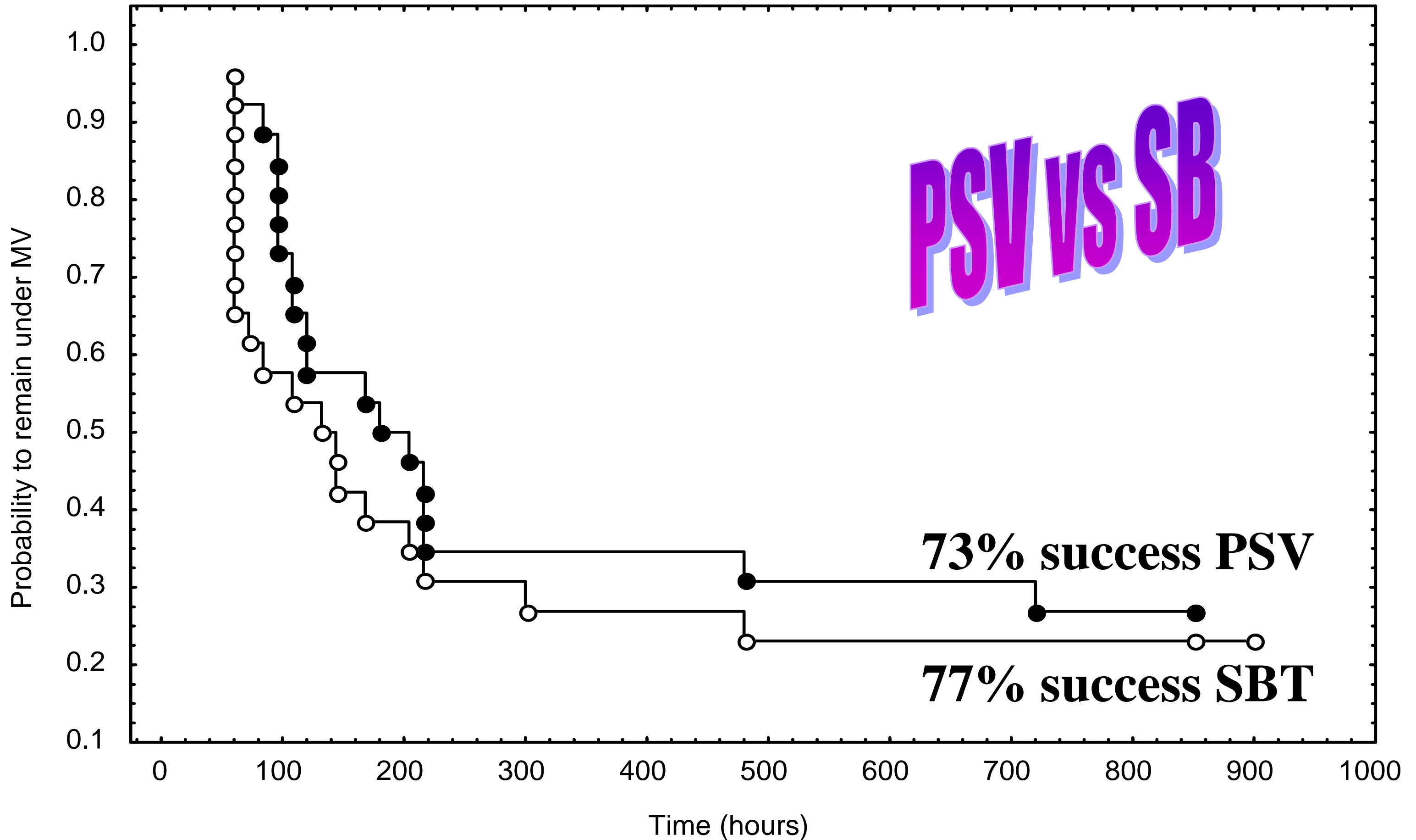


Esteban N Engl J Med 1995

Brochard Am J Respir Crit Care Med 1994

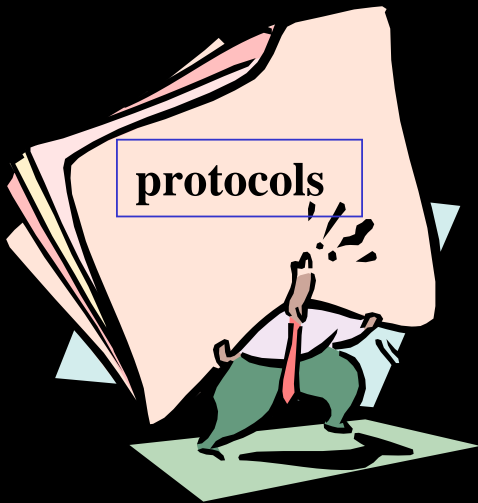
Comparison of Two Methods for Weaning Patients with Chronic Obstructive Pulmonary Disease Requiring Mechanical Ventilation for More Than 15 Days

MICHELE VITACCA, ANDREA VIANELLO, DANIELE COLOMBO, ENRICO CLINI, ROBERTO PORTA, LUCA BIANCHI, GIOVANNA ARCARO, GIOVANNI VITALE, ENRICO GUFFANTI, ALBINO LO COCO, and NICOLINO AMBROSINO



Vitacca M. Am J Respir Crit Care Med 2001; 164: 225-230

Are weaning protocols necessary ?



NO

- Too rigid or cumbersome
- Poor replicability
- Omission of attention during the real life.
- Necessity of educational reinforcement for staff.
- The reduction of time spent in ICU shifts the LOS and the costs in other institutions
- Conflicts between figures
- Useless depends by great differences in care organization in ICUs
- No specific figure of RT in Europe to use them

Are weaning protocols necessary ?

WP cannot be ignored

A strategy to reduce the occurence of medical errors, omissions or delays.

New multidisciplinary mentality:

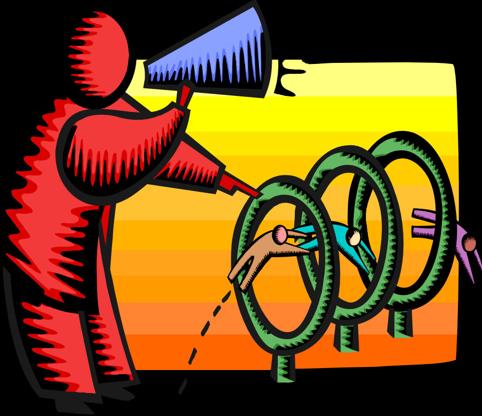
WP obliges to an automated reminders

WP allows simplicity and replicability

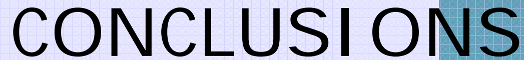
Sufficient level of evidence

WP may save money reducing the n° of doctors

Reccomandations for weaning protocols



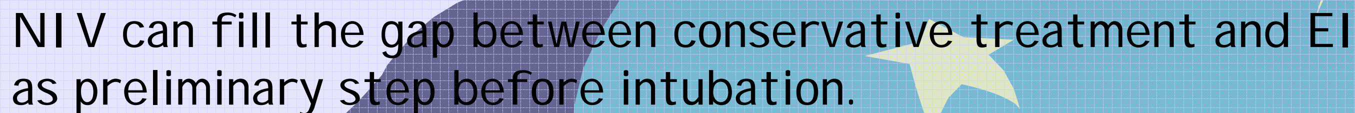
- T piece trial is mandatory
- WP is recommended for young doctors, ICUs with high turn over, ICUs with few dedicated time, ICU with few doctors
- Good for COPD, prolonged weaning attempts (trach), in weaning centres.
- RT should have to be the prevalent figure involved
- WP need to avoid too restrictive selecting criteria potentially delaying weaning.
- when RT are involved, the physicians cannot relegate them the weaning process



CONCLUSIONS

Goals of MV in Acute Respiratory Failure

to buy time for the cause of ARF to subside
to improve pulmonary gas exchange
to increase ventilation and lung volume
to unload the ventilatory muscles
to posticipate EI



NIV can fill the gap between conservative treatment and EI as preliminary step before intubation.

The appropriate disease, condition, severity and contraindications are essential for a correct cost/benefits ratio.

The use of NIV in early stage of exac. of COPD and CPE is clear.

Comparison with EI remains to be elucidated in more severe patients.

NIV instead of EI or after extubation remains debated

"When a protocol is krept into the clinicians' brain it cannot be extirpated surgically"

(MJ.Tobin)

Anarchy of a subjective decision

Rigid driven protocol

Modulated intelligent guides to our job

weaning