2ème Réunion Commune
Cité Centre de Congrès, LYON, France
du 26 au 28 mars 2015

• Choix du mode de ventilateur pour le sevrage des patients des soins intensifs à une unité de soins respiratoires

S. Nava (Bologne, IT)
IS WEANING AN ART OR A SCIENCE?

Prof Milic-Emili

I BELIEVE THERE IS SOME MAGIC IN WEANING

Dr Spock
TIME SPENT ON MECHANICAL VENTILATION

- **Initiation of MV**
- **Weaning time**
- **Discontinuation of MV**

**Potential RICU candidate**
Weaning
-“The process of liberating patients from the ventilator,… begins as soon as the patient is intubated …..

Hall JB, Wood L. JAMA 19

TIME OF MECHANICAL VENTILATION

Treatment of ARF

Weaning process
8 am in an ICU of 12 beds

-9 pts on MV

-3 pts on spontaneous breathing

Who can be discharged to the RICU?

1. One patients liberated from the ventilator needing close monitoring
2. On NIV
3. Tracheotomized on MV
Modes of ventilation to discharge a patient from the ICU to the RICU
Modes of ventilation

VPC  VA  VAC  VACI  VAPS

Automode

VAC+  IPAP  PC  VACI+

VACI  VCRP  CPA  PAC  P

Autoflow

VS  AI

VIV  VA  VAC  VC

NavA  PACI  PA

VS-PPV  SIMV

VPS  VAPS  BILEVEL

PAV  PAV

VCRP  PC

APRVC  APRV

ASB  MMV

BIPAP  SPAP

PsV  PrVC

ATC  VC

Atlas  VPC

Alma Mater Studiorum - Università di Bologna
IS THIS THE RIGHT QUESTION?

or maybe:

HOW CAN I JUDGE THAT A PATIENT IS READY TO BE DISCHARGED FROM THE ICU to THE RICU?
THE LARGE MAJORITY OF PATIENTS CAN BE WEANED EASILY
471 patients self-extubated while on mechanical ventilation.

242 reintubated

51%

49%

229 non reintubated

(i.e. no need for MV)
EFFECT ON THE DURATION OF MECHANICAL VENTILATION OF IDENTIFYING PATIENTS CAPABLE OF BREATHING SPONTANEOUSLY

E. Wesley Elv, 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.

151 patients
Control group

149 patients
Intervention group

300 pts

Daily screening

- PaO2/FiO2 > 200
- PEEP <5cmH2O
- adequate cough
- F/Vt < 105 Breaths/min/L
- no sedatives or vasopressor agents

Daily screening

- PaO2/FiO2 > 200
- PEEP <5cmH2O
- adequate cough
- F/Vt < 105 Breaths/min/L
- no sedatives or vasopressor agents

2 hour Trial of spontaneous breathing
notification of successful results
# Effect on the Duration of Mechanical Ventilation of Identifying Patients Capable of Breathing Spontaneously

**E. Wesley Elvy, 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. Haronik, M.D.**

### End Point | Intervention Group | Control Group | P value
--- | --- | --- | ---
Weaning Time | 1 (0-2) | 3 (2-7) | < 0.001
Mechanical ventilation | 4.5 (2-9) | 6 (3-11) | 0.003
Intensive care | 8 (4-18) | 9 (5-16) | 0.17
Hospital care | 14 (9-26) | 15.5 (6-30) | 0.93

### Graph

**Control (n=151)**

**Intervention (n=149)**

**Patients Receiving Mechanical Ventilation (%)**

**Days after Successful Screening**
Selected 3 cases

- Thoracic trauma with mild COPD
  - 6 days on MV
  - Stable
  - PaO2/FiO2 = 280
  - PS = 12
  - PEEPext = 6

- Young ashtmatic
  - 16 days on MV
  - 3 weaning attempts
  - PS = 18
  - PEEPext = 4

- COPD
  - 4 days on MV
  - Stable
  - Still mild hypercapnia
Selected 3 cases

Thoracic trauma with mild COPD
6 days on MV
Stable
PaO2/FiO2= 280
PS= 12
PEEPext= 6
T tube trial

After 1 hr:
RR = 26 b/min
TV = 300 ml (6,5 ml/Kg)
HR = 92 b/m
Sensorium OK
Partially uncontrolled pain
SaO2 = 93% stable with FiO2 = 30%
“Feel like CAN be extubated, but I am scared”
Rapid Shallow Breathing in a Failed Weaning Patient

A PROSPECTIVE STUDY OF INDEXES PREDICTING THE OUTCOME OF TRIALS OF WEANING FROM MECHANICAL VENTILATION

Karl L. Yang, M.D., and Martin J. Tobin, M.D.

Figure 15 Receiver-operating characteristic (ROC) curves for frequency/tidal volume ratio, $f/V_T$, $P_{1\text{max}}$, and $V_E$. 

- $f/V_T$: ROC curve with an area under the curve (AUC) of 0.89.
- $P_{1\text{max}}$: ROC curve with an AUC of 0.61.
- $V_E$: ROC curve with an AUC of 0.40.
And the patient?
Patients’ prediction of extubation success

### Table 4 Logistic regression analysis: effect of different variables on extubation success

<table>
<thead>
<tr>
<th>Variables</th>
<th>$P$ value</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>0.47</td>
<td>—</td>
</tr>
<tr>
<td>SAPS II&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.96</td>
<td>—</td>
</tr>
<tr>
<td>Investigator</td>
<td>0.28</td>
<td>—</td>
</tr>
<tr>
<td>Study site</td>
<td>0.28</td>
<td>—</td>
</tr>
<tr>
<td>End of SBT</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Confidents</strong></td>
<td>&lt;0.001</td>
<td>9.22 (3.74–22.42)</td>
</tr>
<tr>
<td><strong>Non-confidents</strong></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Age&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>0.001</td>
<td>1.31 (1.28–1.51)</td>
</tr>
<tr>
<td>65</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>75</td>
<td></td>
<td>0.72 (0.66–0.78)</td>
</tr>
</tbody>
</table>
With a RR/VT of 87 do we extubate the patient?

And what about pain and anxiety?
YES,

But remember to take care of the pain and anxiety.

Pain and anxiety however should not prevent weaning and ICU discharge.

Indeed this patient may still need partial support with NIV because of a RR/VT index close to 100.
Noninvasive Ventilation Reduces Intubation in Chest Trauma-Related Hypoxemia

A Randomized Clinical Trial

Gonzalo Hernandez, MD, PhD; Rafael Fernandez, MD, PhD; Pilar Lopez-Reina, MD; Rafael Cuena, MD; Ana Pedrosa, MD; Ramon Ortiz, MD; and Paloma Hiradier, MD

![Graph showing the comparison between NIMV group and control group]
Ramones

Twenty-twenty-twenty-four hours to go, I wanna be sedated.
Nothing to do, nowhere to go, I wanna be sedated.
# DRUGS

<table>
<thead>
<tr>
<th>Drug</th>
<th>Anxiolysis</th>
<th>Hypnosis</th>
<th>Amnesia</th>
<th>Analgesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzodiazepines</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Propofol</td>
<td>+ ▼</td>
<td>+</td>
<td>+*</td>
<td>-</td>
</tr>
<tr>
<td>Opioid analgesics</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Haloperidol</td>
<td>+</td>
<td>+*</td>
<td>+*</td>
<td>-</td>
</tr>
<tr>
<td>α-2 receptors agonists</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

▼ Only at low dose  
* Minimal effect
**Remifentanil**

- Piperidine derivative.
- Selective mu-receptor agonist.
- Potency similar to fentanyl.
- Terminal half-life < 10 min.
- Rapid blood-brain equilibrium.
- Metabolised by non-specific esterases
SIDE EFFECTS

- Oppioids
  - Vasodilatation
  - Respiratory Depression
  - Reduced Intestinal motility
  - Confusion
Sedation During Noninvasive Ventilation (NIV) (REMI)

Pre-REMIFENTANIL

Paw

Pes

Post-REMIFENTANIL

Flow
Selected 3 cases

Young asthmatic
19 days on MV
6 Weaning attempts
PS= 18
PEEPext=4
31 yrs old asthmatic woman

19 days of MV
6 weaning attempts
CMV = Vt = 7 ml/Kg
PEEP_{ext} = 4
Complicated story
- Insulin-dependent diabetes
- Curarized and sedated for 7 days
- Sedated every night (to allow sleep)
- High doses of steroids (i.e. methylprednisolone 80 mg x 3/die, now 60 mg /die
Tracheotomized on day 14
The problem of tracheostomy timing: early is better than late?
Systematic review and meta-analysis of studies of the timing of tracheostomy in adult patients undergoing artificial ventilation

John Griffiths, Vicki S Barber, Lesley Morgan and J Duncan Young

BMJ 2005;330;1243-; originally published online 18 May 2005;
doi:10.1136/bmj.38487.485671.E0

![Table showing relative risks and confidence intervals for early versus late tracheostomy](image)

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Fig 2 Random effects meta-analysis of relative risk (95% confidence interval) of mortality with early compared with late tracheostomy

---

![Table showing relative risks and confidence intervals for early versus late tracheostomy](image)

---

Fig 3 Random effects meta-analysis of relative risk (95% confidence interval) of hospital acquired pneumonia with early compared with late tracheostomy
Early vs Late Tracheotomy for Prevention of Pneumonia in Mechanically Ventilated Adult ICU Patients
A Randomized Controlled Trial

Gray test $P = .07$
Potential complication of CMV: Ventilator-Induced Diaphragmatic Dysfunction

• “Loss of diaphragmatic force generating capacity that is specifically related to the use of controlled mechanical ventilation”

Vassilakopoulos T et al. AJRCCM 2004;169: 336-341
Effects of prolonged mechanical ventilation on respiratory muscle ultrastructure and mitochondrial respiration in rabbits.

gitudinal sections. a Diaphragm of ventilated rabbit, ×6,000. Disruption and fragmentation of myofibrils, with large interfibrillar space. 1 Disintegrated sarcomere; 2 preserved sarcomere; 3 sarcoplasmic disorganization.
Rapid Disuse Atrophy of Diaphragm Fibers in Mechanically Ventilated Humans

Weaning through tracheotomy in the RICU
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


SB vs PSV
Is this feasible in the medical ward?
Ward mortality in patients discharged from the ICU with tracheostomy may depend on patient’s vulnerability.
Selected 3 cases

COPD
4 days on MV
Stable
Still mild hypercapnia
COPD 68 yrs old male
MI 4 yrs ago
ETI 4 days ago
Stable
Mild hypercapnia (PaCO2 56.2 mmHg)
Normal sensorium
Cogh reflex preserved
No sepsis
No fever
T-tube trial

- **After 1 h**
  - RR= 30 b/min
  - TV= 220 ml
  - HR= 92 b/m

- **ABG at the end of trial:**
  - PaO2= 67.8 mmHg
  - PaCO2= 58.9 mmHg
  - pH= 7.33
Should we extubate him and eventually discharge to the RICU?
Which mode?
**Comparison of Weaning time**

Brochard et al.  Esteban et al.

<table>
<thead>
<tr>
<th>Method</th>
<th>Brochard (days)</th>
<th>Esteban (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMV</td>
<td>9.9 ± 1.3</td>
<td>6.2 ± 0.8</td>
</tr>
<tr>
<td>PSV</td>
<td>5.7 ± 0.7</td>
<td>4.8 ± 0.7</td>
</tr>
<tr>
<td>T-piece (m)</td>
<td>8.5 ± 1.4</td>
<td>3.8 ± 0.5</td>
</tr>
<tr>
<td>T-piece (s)</td>
<td>3.4 ± 0.5</td>
<td></td>
</tr>
</tbody>
</table>

**Diagram:**

- **PROBABILITY OF REMAINING ON MECHANICAL VENTILATION**
  - SIMV
  - T PIECE
  - PSV

- **Probability of Successful Weaning**
  - Intermittent trials
  - Once-daily trial
  - Pressure-support ventilation
  - Intermittent mandatory ventilation

**Duration of Weaning (days):**

0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0

0 5 10 15 20 25
Can NIV work as a Weaning alternative?

- Is NIV “true” mechanical ventilation?
- Is NIV effective to prevent need for intubation?
- May NIV represent an alternative to conventional invasive ventilation?
### TABLE 3. ARTERIAL BLOOD GASES DURING MECHANICAL VENTILATION AND AT THE END OF THE T-PIECE TRIAL

<table>
<thead>
<tr>
<th></th>
<th>i-PSV</th>
<th>n-PSV</th>
<th>T-piece</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH</td>
<td>7.38 ± 0.03</td>
<td>7.38 ± 0.04</td>
<td>7.33 ± 0.04*</td>
</tr>
<tr>
<td>PaO₂/FiO₂</td>
<td>206.8 ± 41.9</td>
<td>210.2 ± 47.4</td>
<td>183.1 ± 49.5</td>
</tr>
<tr>
<td>PaCO₂, mm Hg</td>
<td>59.1 ± 10.5</td>
<td>61.0 ± 12.0</td>
<td>69.0 ± 15.6*</td>
</tr>
</tbody>
</table>

* p < 0.01, i-PSV and n-PSV versus T-piece.
<table>
<thead>
<tr>
<th>Study</th>
<th>No of patients</th>
<th>Inclusion criteria (patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nava, 1998</td>
<td>50</td>
<td>Exacerbation of COPD. Intubated for at least 36-48 hrs</td>
</tr>
<tr>
<td>Girault, 1999</td>
<td>33</td>
<td>Acute-on-chronic respiratory failure (COPD, restrictive, or mixed populations). Intubated for at least 48 hrs</td>
</tr>
<tr>
<td>Hill, 2000</td>
<td>21</td>
<td>Acute respiratory failure</td>
</tr>
<tr>
<td>Chen, 2001</td>
<td>24</td>
<td>Exacerbation of COPD. Intubated for at least 48-60 hrs. Saturations &gt;88% on FiO2 40%</td>
</tr>
<tr>
<td>Ferrer, 2003</td>
<td>43</td>
<td>Acute respiratory failure and persistent weaning failure. Intubated for at least 72 hrs</td>
</tr>
<tr>
<td>Rabie, 2004</td>
<td>37</td>
<td>Exacerbation of COPD</td>
</tr>
<tr>
<td>Wang, 2004</td>
<td>28</td>
<td>COPD. Bronchopulmonary infection</td>
</tr>
<tr>
<td>Zheng, 2005</td>
<td>33</td>
<td>COPD. Severe pulmonary infection</td>
</tr>
<tr>
<td>Zou, 2006</td>
<td>76</td>
<td>COPD with severe respiratory failure. Pulmonary infection</td>
</tr>
<tr>
<td>Wang, 2005</td>
<td>90</td>
<td>COPD with severe hypercapnic respiratory failure. Pneumonia or purulent bronchitis. Age ≤85. Capable of self care in past year</td>
</tr>
<tr>
<td>Trevisan, 2008</td>
<td>65</td>
<td>Invasively ventilated ≥48 hours</td>
</tr>
<tr>
<td>Shiva Prasad</td>
<td>30</td>
<td>COPD. Hypercapnic respiratory failure</td>
</tr>
</tbody>
</table>

Use of non-invasive ventilation to wean critically ill adults off invasive ventilation: meta-analysis and systematic review

Karen E A Burrow, clinical scientist; ^1^ scientist, ^2^ assistant professor of medicine; ^3^ Neil J Adhikari, intensivist, ^4^ associate scientist; ^5^ lecturer; ^6^ Sean P Keenan, head; ^7^ clinical assistant professor of medicine; ^8^ Maureen Meade, associate professor of medicine

530 patients
### Use of non-invasive ventilation to wean critically ill adults off invasive ventilation: meta-analysis and systematic review

#### Chronic obstructive pulmonary disease

<table>
<thead>
<tr>
<th>Study</th>
<th>Non-invasive weaning</th>
<th>Invasive weaning</th>
<th>Relative risk (random) (95% CI)</th>
<th>Weight (%)</th>
<th>Relative risk (random) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nava 1998^a</td>
<td>2/25</td>
<td>7/25</td>
<td></td>
<td>6.10</td>
<td>0.29 (0.07 to 1.24)</td>
</tr>
<tr>
<td>Chen 2001^a</td>
<td>0/12</td>
<td>3/12</td>
<td></td>
<td>1.61</td>
<td>0.14 (0.01 to 2.50)</td>
</tr>
<tr>
<td>Rabie 2004^a</td>
<td>1/19</td>
<td>2/18</td>
<td></td>
<td>2.47</td>
<td>0.47 (0.05 to 4.78)</td>
</tr>
<tr>
<td>Wang 2004^a</td>
<td>1/14</td>
<td>2/14</td>
<td></td>
<td>2.53</td>
<td>0.50 (0.05 to 4.90)</td>
</tr>
<tr>
<td>Wang 2005^a</td>
<td>1/47</td>
<td>7/43</td>
<td></td>
<td>3.12</td>
<td>0.13 (0.02 to 1.02)</td>
</tr>
<tr>
<td>Zheng 2005^a</td>
<td>3/17</td>
<td>3/16</td>
<td></td>
<td>6.29</td>
<td>0.94 (0.22 to 4.00)</td>
</tr>
<tr>
<td>Zou 2006^a</td>
<td>3/38</td>
<td>11/38</td>
<td></td>
<td>9.24</td>
<td>0.27 (0.08 to 0.90)</td>
</tr>
<tr>
<td>Prasad 2008^a</td>
<td>5/15</td>
<td>9/15</td>
<td></td>
<td>19.31</td>
<td>0.56 (0.24 to 1.27)</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>187</td>
<td>181</td>
<td></td>
<td>50.66</td>
<td>0.42 (0.25 to 0.69)</td>
</tr>
<tr>
<td><strong>Total events</strong></td>
<td>16</td>
<td>44</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test for heterogeneity $\chi^2 = 4.48$, df=7, $P=0.72$, $I^2=0$

Test for overall effect $z=3.37$, $P<0.001$

#### Mixed

<table>
<thead>
<tr>
<th>Study</th>
<th>Non-invasive weaning</th>
<th>Invasive weaning</th>
<th>Relative risk (random) (95% CI)</th>
<th>Weight (%)</th>
<th>Relative risk (random) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girault 1999^a</td>
<td>0/17</td>
<td>2/16</td>
<td></td>
<td>1.50</td>
<td>0.19 (0.01 to 3.66)</td>
</tr>
<tr>
<td>Hill 2000^a</td>
<td>1/12</td>
<td>1/9</td>
<td></td>
<td>1.90</td>
<td>0.75 (0.05 to 10.44)</td>
</tr>
<tr>
<td>Ferrer 2003^a</td>
<td>6/21</td>
<td>13/22</td>
<td></td>
<td>22.80</td>
<td>0.48 (0.13 to 1.03)</td>
</tr>
<tr>
<td>Trevisan 2008^a</td>
<td>9/28</td>
<td>10/37</td>
<td></td>
<td>23.13</td>
<td>1.19 (0.56 to 2.53)</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>78</td>
<td>84</td>
<td></td>
<td>49.34</td>
<td>0.72 (0.39 to 1.32)</td>
</tr>
<tr>
<td><strong>Total events</strong></td>
<td>16</td>
<td>26</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test for heterogeneity $\chi^2 = 3.54$, df=3, $P=0.32$, $I^2=15.4$

Test for overall effect $z=1.06$, $P=0.29$

**Total**

<table>
<thead>
<tr>
<th>Non-invasive weaning</th>
<th>Invasive weaning</th>
<th>Relative risk (random) (95% CI)</th>
<th>Weight (%)</th>
<th>Relative risk (random) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>265</td>
<td>265</td>
<td></td>
<td>100</td>
<td>0.55 (0.38 to 0.79)</td>
</tr>
<tr>
<td>32</td>
<td>70</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test for heterogeneity $\chi^2 = 10.46$, df=11, $P=0.49$, $I^2=0$

Test for overall effect $z=3.24$, $P=0.001$

---

**Fig 2** | Effect of non-invasive and invasive weaning on mortality in critically ill adults on invasive ventilation
Use of non-invasive ventilation to wean critically ill adults off invasive ventilation: meta-analysis and systematic review

Karen E A Burns, clinical scientist,¹ scientist,² assistant professor of medicine,³ Neill K J Adhikari, intensivist,⁴ associate scientist,⁵ lecturer,⁶ Sean P Keenan, head,⁷ clinical assistant professor of medicine,⁸ Maureen Meade, associate professor of medicine⁹

<table>
<thead>
<tr>
<th>Study</th>
<th>Non-invasive weaning</th>
<th>Invasive weaning</th>
<th>Relative risk (random) (95% CI)</th>
<th>Weight (%)</th>
<th>Relative risk (random) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nava 1998⁰</td>
<td>0/25</td>
<td>7/25</td>
<td>2.39 0.07 (0.00 to 1.11)</td>
<td>2.62</td>
<td>2.62 0.94 (0.06 to 13.82)</td>
</tr>
<tr>
<td>Girault 1999⁰</td>
<td>1/17</td>
<td>1/16</td>
<td>2.48 0.07 (0.00 to 1.05)</td>
<td>2.48</td>
<td>2.48 0.31 (0.01 to 0.07)</td>
</tr>
<tr>
<td>Chen 2001⁰</td>
<td>0/12</td>
<td>7/12</td>
<td>26.74 0.40 (0.17 to 0.93)</td>
<td>2.32</td>
<td>2.32 0.11 (0.01 to 1.83)</td>
</tr>
<tr>
<td>Ferrer 2003⁰</td>
<td>5/21</td>
<td>13/22</td>
<td>5.01 0.13 (0.02 to 0.87)</td>
<td>5.01</td>
<td>5.01 0.78 (0.23 to 1.07)</td>
</tr>
<tr>
<td>Rable 2004⁰</td>
<td>0/19</td>
<td>4/18</td>
<td>13.21 0.23 (0.07 to 0.76)</td>
<td>4.36</td>
<td>4.36 0.24 (0.03 to 1.89)</td>
</tr>
<tr>
<td>Wang 2004⁰</td>
<td>1/14</td>
<td>8/14</td>
<td>31.33 0.47 (0.21 to 1.01)</td>
<td>4.61</td>
<td>4.61 0.20 (0.03 to 1.51)</td>
</tr>
<tr>
<td>Wang 2005⁰</td>
<td>3/47</td>
<td>12/43</td>
<td>4.94 0.08 (0.01 to 0.55)</td>
<td>4.94</td>
<td>4.94 0.29 (0.19 to 0.45)</td>
</tr>
<tr>
<td>Zheng 2005⁰</td>
<td>1/17</td>
<td>4/16</td>
<td>4.94 0.08 (0.01 to 0.55)</td>
<td>4.94</td>
<td>4.94 0.29 (0.19 to 0.45)</td>
</tr>
<tr>
<td>Zou 2006⁰</td>
<td>7/38</td>
<td>15/38</td>
<td>4.94 0.08 (0.01 to 0.55)</td>
<td>4.94</td>
<td>4.94 0.29 (0.19 to 0.45)</td>
</tr>
<tr>
<td>Prasad 2008⁰</td>
<td>1/15</td>
<td>5/15</td>
<td>4.94 0.08 (0.01 to 0.55)</td>
<td>4.94</td>
<td>4.94 0.29 (0.19 to 0.45)</td>
</tr>
<tr>
<td>Trevisan 2008⁰</td>
<td>1/28</td>
<td>17/37</td>
<td>4.94 0.08 (0.01 to 0.55)</td>
<td>4.94</td>
<td>4.94 0.29 (0.19 to 0.45)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>253</td>
<td>256</td>
<td>100.00 0.29 (0.19 to 0.45)</td>
<td>100.00</td>
<td>100.00 0.29 (0.19 to 0.45)</td>
</tr>
<tr>
<td><strong>Total events</strong></td>
<td>20</td>
<td>93</td>
<td>0.001 0.01 0.1 1 10 100 1000</td>
<td>0.001</td>
<td>0.001 0.01 0.1 1 10 100 1000</td>
</tr>
</tbody>
</table>

Test for heterogeneity χ²=9.24, df=10, P=0.51, I²=0%
Test for overall effect z=5.55, P<0.001

Fig 3 Effect of alternative weaning strategies on ventilator associated pneumonia in critically ill adults on invasive ventilation
Are we save to discharge these patients immediately after extubation in the RICU?
Noninvasive Ventilation and Weaning in Patients with Chronic Hypercapnic Respiratory Failure
A Randomized Multicenter Trial

Christophe Girault¹,², Michael Bubenheim³, Fekri Abroug⁴, Jean Luc Diehl⁵, Souheil Elatrous⁶, Pascal Beuret⁷, Jack Richcoeur⁸, Erwan L’Her⁹, Gilles Hilbert¹⁰, Gilles Capellier¹¹, Antoine Rabbat¹², Mohamed Besbes¹³, Claude Guérin¹⁴, Philippe Guiot¹⁵, Jacques Bénichou¹³,¹⁶, and Guy Bonmarchand¹,², for the VENISE Trial Group*


Graph: Cumulative probability of post-extubation ARF, reintubation or death

- Invasive weaning group n = 69
- O₂ group n = 70
- NIV group n = 69

p < 0.001 (log-rank)
CONCLUSIONS

An “ideal” ventilatory mode to transfer a patient from the ICU to the RICI does NOT exist.

Probably this is NOT a critical issue in the process.

A patient still on invasive mechanical ventilation can be successfully weaned when already tracheotomized.

A RICU team must be confident not only with NIV but also with sedation and analgesis procedures.