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# 4ème JOURNEE DE RECHERCHE EN KINESITHERAPIE RESPIRATOIRE

**SAMEDI 25 JUIN 2011**

# QUELQUES DOMAINES DE RECHERCHE EN KINESITHERAPIE

# *REANIMATION*

J. Roeseler, E. Bialais, Ch. Hickman, P-F. Laterre

RESPIRATOIRE

ORTHOPEDIQUE

**RECHERCHE**

CARDIO-VASCULAIRE

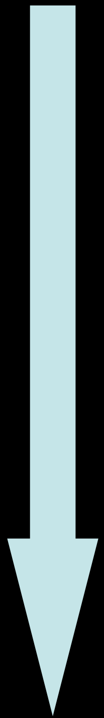
NEUROLOGIQUE

- Héliox
- Techniques Instrumentales
- Aérosolthérapie
- V.N.I.
- Ventilation mécanique
- Oxygénothérapie à haut débit
- Mobilisation précoce

# Bases théoriques

- Hélium = gaz inerte à faible densité
- Le fait de ventiler avec Heliox... Ecoulement gazeux est amélioré ===> les résistances diminuent fortement ( de 28 à 49%).
- L'Heliox ne traite pas la pathologie initiale
- Le maximum d'efficacité s'obtient si 21% $O_2$.

# *Pourquoi diminuer la densité ?*



**Travail respiratoire**

**Volume trappé**

**PEP i**

**Dyspnée**

# ***Pour qui diminuer la densité ?***

- **Sténose des VAS**
- **Asthme**
- **BPCO**
- **Bronchiolite oblitérante**

# HELIOX ET MODELE ANIMAL?

Intensive Care Med (2003) 29:119–125
DOI 10.1007/s00134-002-1562-5

EXPERIMENTAL

Christine Watremez
Jean Roeseler
Marc De Kock
Thierry Clerbaux
Bruno Detry
Claude Veriter
Marc Reynaert
Pierre Gianello
Philippe Jolliet
Giuseppe Liistro

# An improved porcine model of stable methacholine-induced bronchospasm

Intensive Care Medicine

10.1007/s00134-003-1779-y

Experimental

# Effects of helium-oxygen on respiratory mechanics, gas exchange, and ventilation-perfusion relationships in a porcine model of stable methacholine-induced bronchospasm

Christine Watremez[2], Giuseppe Liistro[3], Marc deKock[2], Jean Roeseler[4], Thierry Clerbaux[3], Bruno Detry[3], Marc Reynaert[4], Pierre Gianello[5] and Philippe Jolliet[1]

# HELIOX ET B.P.C.O. ?

# Effects of helium-oxygen on intrinsic positive end-expiratory pressure in intubated and mechanically ventilated patients with severe chronic obstructive pulmonary disease

Didier Tassaux, MD; Philippe Jolliet, MD; Jean Roeseler, RT; Jean-Claude Chevrolet, MD

*Objective:* To test the hypothesis that replacing 70:30 nitrogen:oxygen (Air-$O_2$) with 70:30 helium:oxygen (He-$O_2$) can decrease dynamic hyperinflation ("intrinsic" positive end-expiratory pressure) in mechanically ventilated patients with chronic obstructive pulmonary disease (COPD), and to document the consequences of such an effect on arterial blood gases and hemodynamics.

*Design:* Prospective, interventional study.

*Setting:* Medical intensive care unit, university tertiary care center.

*Patients:* Twenty-three intubated, sedated, paralyzed, and mechanically ventilated patients with COPD enrolled within 36 hrs after intubation.

*Interventions:* Measurements were taken at the following time points, all with the same ventilator settings: a) baseline; b) after 45 mins with He-$O_2$; c) 45 mins after return to Air-$O_2$. The results were then compared to those obtained in a test lung model using the same ventilator settings.

*Main Results (mean ± SD):* Trapped lung volume and intrinsic positive end-expiratory pressure decreased during He-$O_2$ ventilation (215 ± 125 mL vs. 99 ± 15 mL and 9 ± 2.5 cm $H_2O$ vs. 5 ± 2.7 cm $H_2O$, respectively; $p < .05$). Likewise, peak and mean airway pressures declined with He-$O_2$ (30 ± 5 cm $H_2O$ vs. 25 ± 6 cm $H_2O$ and 8 ± 2 cm $H_2O$ vs. 7 ± 2 cm $H_2O$, respectively; $p < .05$). These parameters all rose to their baseline values on return to Air-$O_2$ ($p < .05$ vs. values during He-$O_2$). These results were in accordance with those obtained in the test lung model. There was no modification of arterial blood gases, heart rate, or mean systemic arterial blood pressure. In 12/23 patients, a pulmonary artery catheter was in place, allowing hemodynamic measurements and venous admixture calculations. Switching to He-$O_2$ and back to Air-$O_2$ had no effect on pulmonary artery pressures, right and left ventricular filling pressures, cardiac output, pulmonary and systemic vascular resistance, or venous admixture.

*Conclusion:* In mechanically ventilated COPD patients with intrinsic positive end-expiratory pressure, the use of He-$O_2$ can markedly reduce trapped lung volume, intrinsic positive end-expiratory pressure, and peak and mean airway pressures. No effect was noted on hemodynamics or arterial blood gases. He-$O_2$ might prove beneficial in this setting to reduce the risk of barotrauma, as well as to improve hemodynamics and gas exchange in patients with very high levels of intrinsic positive end-expiratory pressure. (Crit Care Med 2000; 28:2721–2728)

KEY WORDS: chronic obstructive pulmonary disease; mechanical ventilation; intrinsic positive end-expiratory pressure; helium; heliox; gas exchange

# Helium-oxygen versus air-oxygen noninvasive pressure support in decompensated chronic obstructive disease: A prospective, multicenter study*

Philippe Jolliet; Didier Tassaux; Jean Roeseler; Luc Burdet; Alain Broccard; William D'Hoore; François Borst; Marc Reynaert; Marie-Denise Schaller; Jean-Claude Chevrolet

*Objective:* To study whether noninvasive pressure support ventilation (NIPSV) with helium/oxygen (He/oxygen), which can reduce dyspnea, $Pa_{CO_2}$, and work of breathing more than NIPSV with air/oxygen in decompensated chronic obstructive pulmonary disease, could have beneficial consequences on outcome and hospitalization costs.

*Design:* Prospective, randomized, multicenter study.

*Setting:* Intensive care units of three tertiary care university hospitals.

*Patients:* All patients with chronic obstructive pulmonary disease admitted to the intensive care units for NIPSV during a 24-month period.

*Interventions:* Patients were randomized to NIPSV with air/oxygen or He/oxygen. NIPSV settings, number of daily trials, decision to intubate, and intensive care unit and hospital discharge criteria followed standard practice guidelines.

*Results:* A total of 123 patients (male/female ratio, 71:52; age, 71 ± 10 yrs, Acute Physiology and Chronic Health Evaluation II, 17 ± 4) were included. Intubation rate (air/oxygen 20% vs. He/oxygen 13%) and length of stay in the intensive care unit (air/oxygen 6.2 ± 5.6 vs. He/oxygen 5.1 ± 4 days) were comparable. The post–intensive care unit hospital stay was lower with He/oxygen (air/oxygen 19 ± 12 vs. He/oxygen 13 ± 6 days, $p < .002$). Cost of NIPSV gases was higher with He/oxygen, but total hospitalization costs were lower by $3,348 per patient with He/oxygen. No complications were associated with the use of He/oxygen.

*Conclusion:* He/oxygen did not significantly reduce intubation rate or intensive care unit stay, but hospital stay was shorter and total costs were lower. He/oxygen NIPSV can be safely administered and could prove to be a cost-effective strategy. (Crit Care Med 2003; 31:878–884)

KEY WORDS: mechanical ventilation; noninvasive ventilation; heliox; helium; chronic obstructive pulmonary disease; outcome

# HELIOX ET AEROSOLTHERAPIE ?

## Summary

Heliox-driven albuterol nebulization is generating increased interest, and most of the recent clinical adult and pediatric studies have found that heliox benefits patients in severe asthma exacerbations. Further studies are needed to determine the role of heliox-driven albuterol nebulization in the care of asthma exacerbations in the emergency department and intensive care unit.

The health-care provider faces several choices when a patient's asthma exacerbation does not respond well to conventional $\beta_2$-agonist and corticosteroid therapy. The options include heliox-driven albuterol therapy, parenteral $\beta_2$-agonist therapy, parenteral or inhaled magnesium therapy, and noninvasive positive-pressure ventilation. Larger studies are needed on emergency-department admission rates, intensive-care-unit and hospital stay, and intubation rate to determine the best approach for escalating care of patients suffering asthma exacerbations.

# HELIOX ET SEVRAGE RESPIRATOIRE DU PATIENT B.P.C.O. ?

REHABILITATION
DES PATIENTS BPCO :

+ VNI ….. Oui
+ VNI + HELIOX ?

# ***Nouvelle étude sur Héliox BPCO***

## **Comparaison Ventilation Air-Ox vs Heliox**

## **VNI + Respiration spontanée pendant 48 heures**

- N = +/-750
- Etude multicentrique (+/- 30 centres)
- Etude prospective
- Etude randomisée
-
- Buts
  + Nombre d'intubation
  + Durée de séjour
  + Mortalité
  + Coût
  + …..

# Héliox et …… poupée gonflable ????

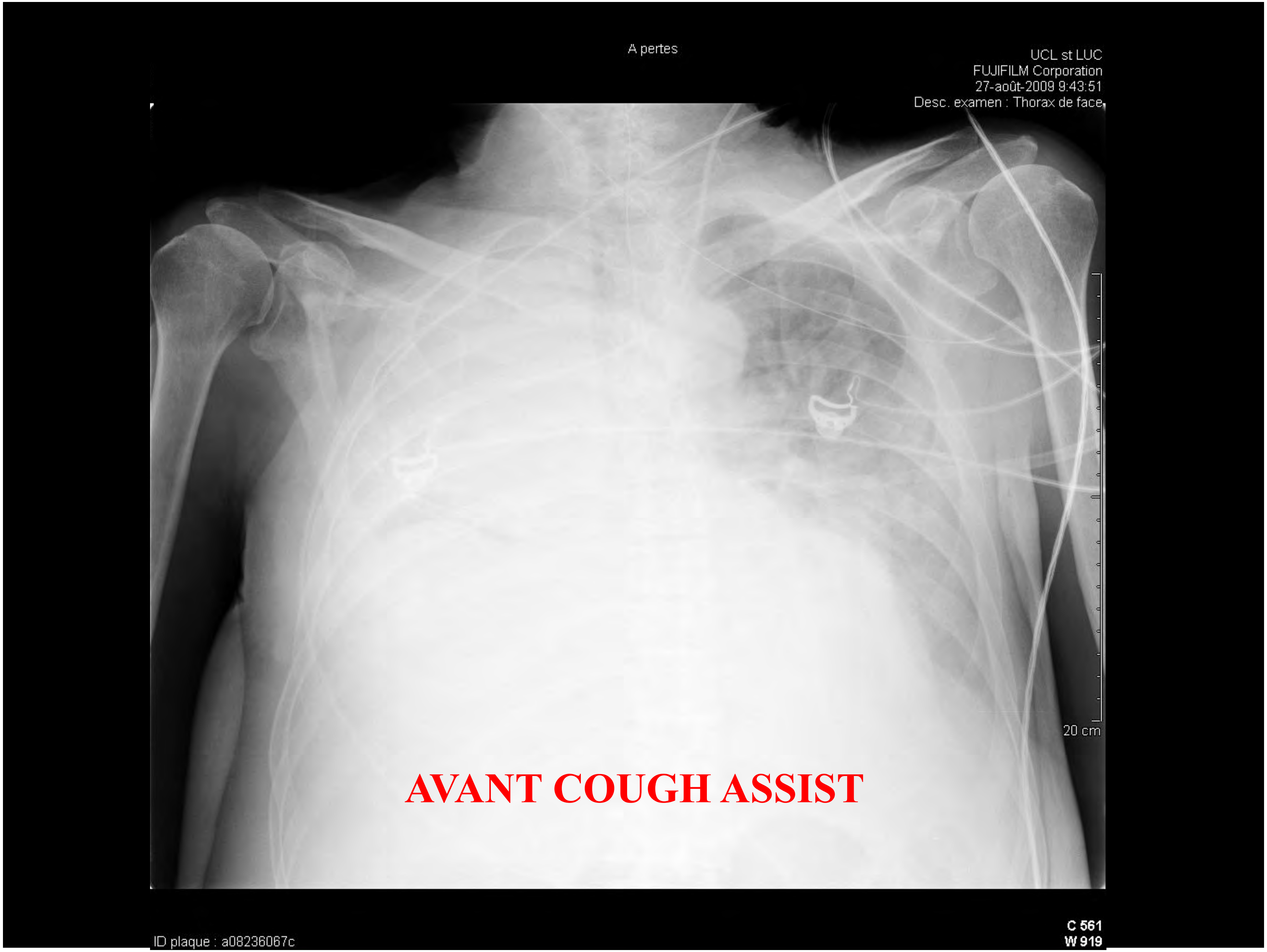
- Héliox
- Techniques Instrumentales
- Aérosolthérapie
- V.N.I.
- Ventilation mécanique
- Oxygénothérapie à haut débit
- Mobilisation précoce

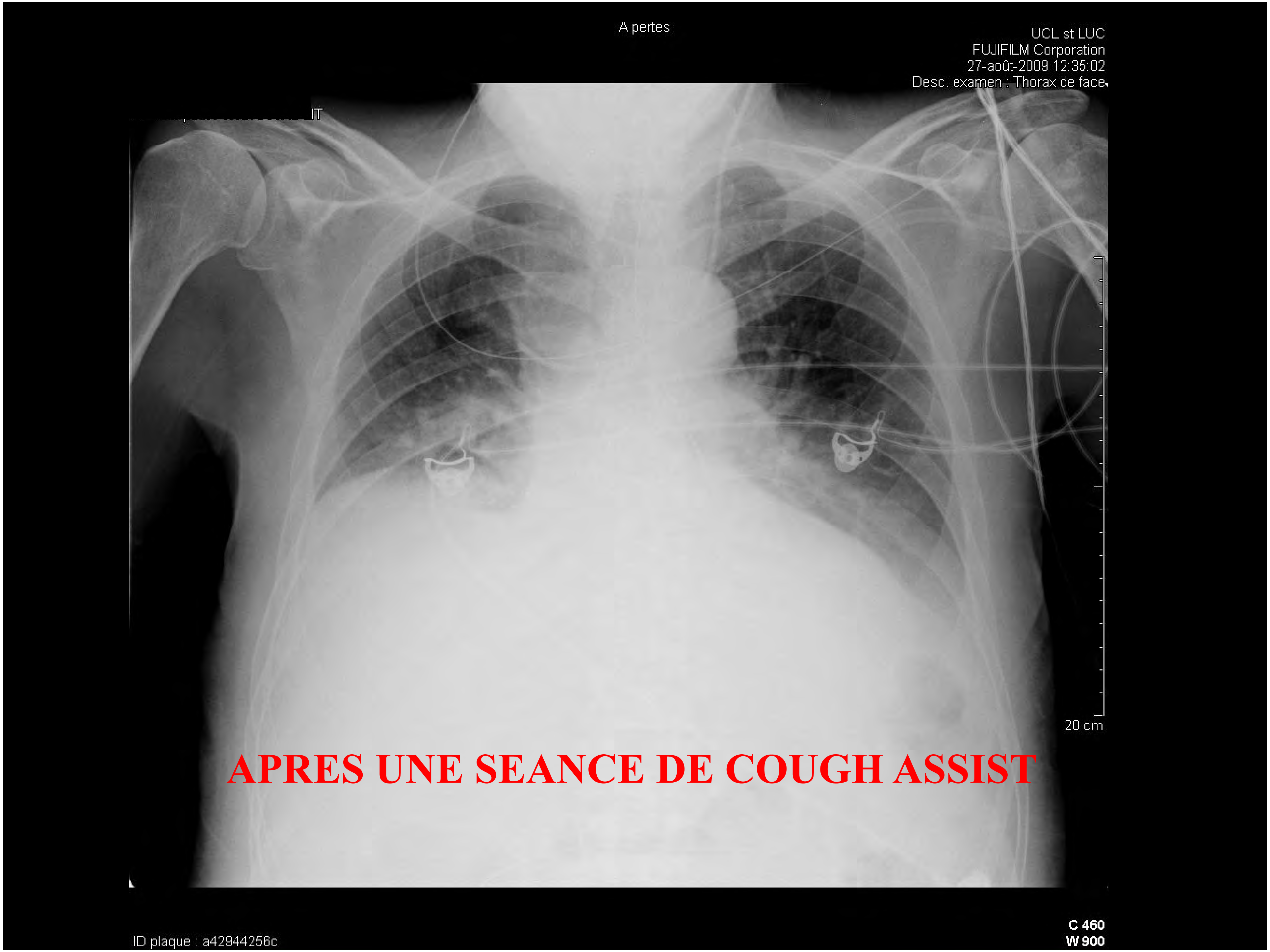
# ***Techniques***

- IPPB
- Flutter
- PEP Mask
- The Vest
- Percussionnaire
- Cough Assist
- A.E.T.
- Spirométrie Incitative
- CPAP ?
- Bi-PAP ?
- ……….

# IPPB *ou* Relaxateur de pression

# Cough Assit


A pertes
UCL st LUC
FUJIFILM Corporation
27-août-2009 9:43:51
Desc. examen : Thorax de face
20 cm
AVANT COUGH ASSIST
ID plaque : a08236067c
C 561
W 919


A pertes
UCL st LUC
FUJIFILM Corporation
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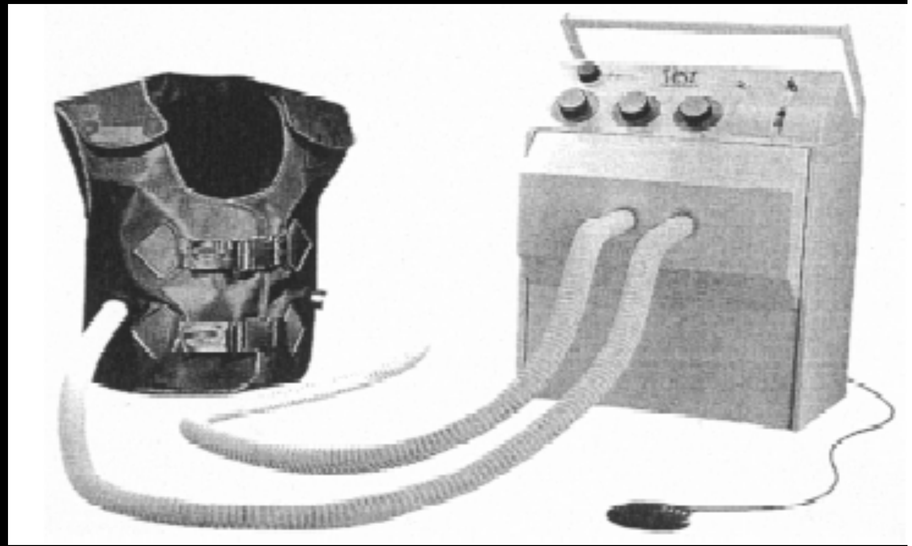
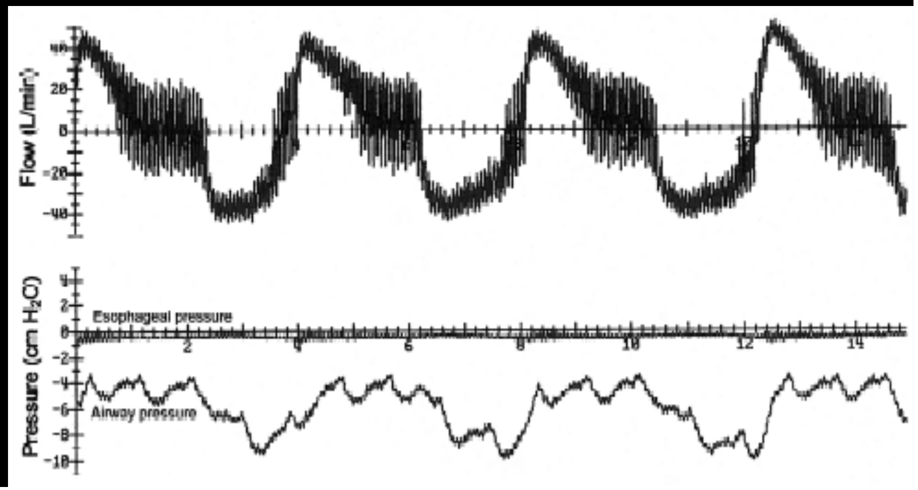
Desc. examen : Thorax de face
20 cm
APRES UNE SEANCE DE COUGH ASSIST
ID plaque : a42944256c
C 460
W 900

# The Vest





Flow (L/min)
Pressure (cm H2O)
Esophageal pressure
Airway pressure


Incentive Spirometer

- Buts ?
- Pour qui ?
- Modes d'action ?
- Réglages ?
- Techniques associées ?
- Limites ?

- Héliox
- Techniques Instrumentales
- Aérosolthérapie
- V.N.I.
- Ventilation mécanique
- Oxygénothérapie à haut débit
- Mobilisation précoce

# *Aérosolthérapie*

- Type d'appareillage ?
- Et VNI ?
- Et ventilation mécanique
  - Emplacement sur le circuit ?
  - Mode ventilatoire ?
  - Modification des réglages ?
  - Synchronisation ?
- ……

- Héliox
- Techniques Instrumentales
- Aérosolthérapie
- V.N.I.
- Ventilation mécanique
- Oxygénothérapie à haut débit
- Mobilisation précoce

# *V.N.I. et toute forme d'insuffisance respiratoire aiguë*

- **B.P.C.O.**
  + pH ?
  + $PaCO_2$ ?
  + …

- **O.A.P. cardiogénique**
  + CPAP ?
  + BiPAP ?

- **Pneumonie ?**

- **I.R.A. du patient neuro-musculaire**
  + Situation aiguë
  + Décompensation de la pathologie

- **Asthme ?**

- **Post-extubation ?**

- **Sevrage précoce ?**

- **Après chirurgie thoracique ou abdominale ?**

- **Mucoviscidose ?**

## ***V.N.I.***

**- Interface ?**

**- Type de respirateur ?**

**- Humidification des gaz respiratoires ?**

**- Mode ventilatoire ?**

**- Désencombrement ?**

**- Sédation ?**

**- Sommeil ?**

**- .....**

CHEST®

Official publication of the American College of Chest Physicians

CHEST PAPERS IN PRESS

# Non-invasive ventilation in COPD: Impact of inspiratory pressure levels on sleep quality : A randomized cross-over trial

Michael Dreher, Emelie Ekkernkamp, Stephan Walterspacher, David Walker, Claudia Schmoor, Jan H Storre and Wolfram Windisch

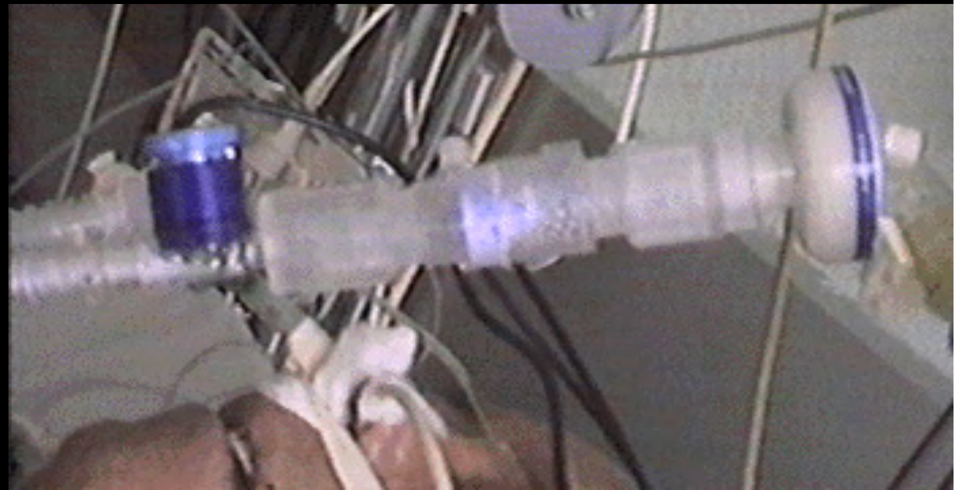
*Chest*; Prepublished online May 12, 2011;
DOI 10.1378/chest.11-0253

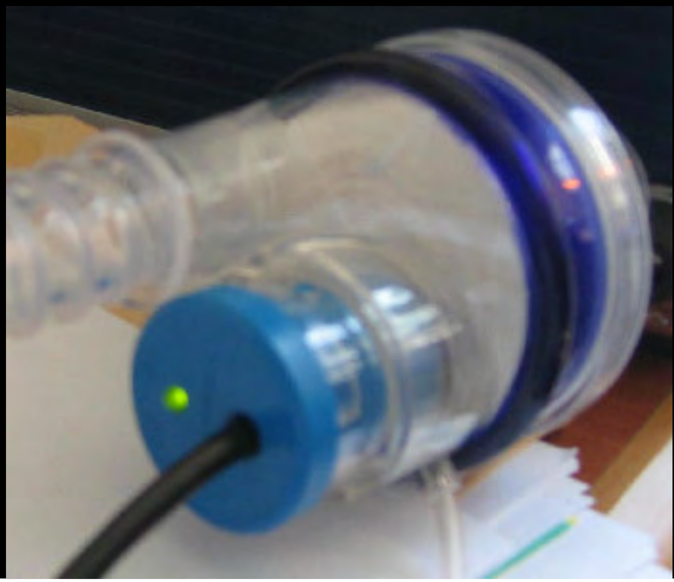
[redacted]

In conclusion, high-intensity non-invasive positive pressure ventilation used in a controlled mode with a mean inspiratory positive airway pressure of 29 mbar is associated with acceptable sleep quality, which is similar rather than reduced in comparison to low-intensity non-invasive positive pressure ventilation. Furthermore, high-intensity noninvasive positive pressure ventilation is superior in controlling nocturnal hypoventilation compared to low-intensity non-invasive positive pressure ventilation. High-intensity NPPV is a very promising new approach for treating stable hypercapnic COPD-patients; however, an important question remains: Is high-intensity NPPV also capable of improving long-term survival? To address this, long-term randomized controlled trials are urgently needed.

[redacted]

# Humidification





- Héliox
- Techniques Instrumentales
- Aérosolthérapie
- V.N.I.
- Ventilation mécanique
- Oxygénothérapie à haut débit
- Mobilisation précoce

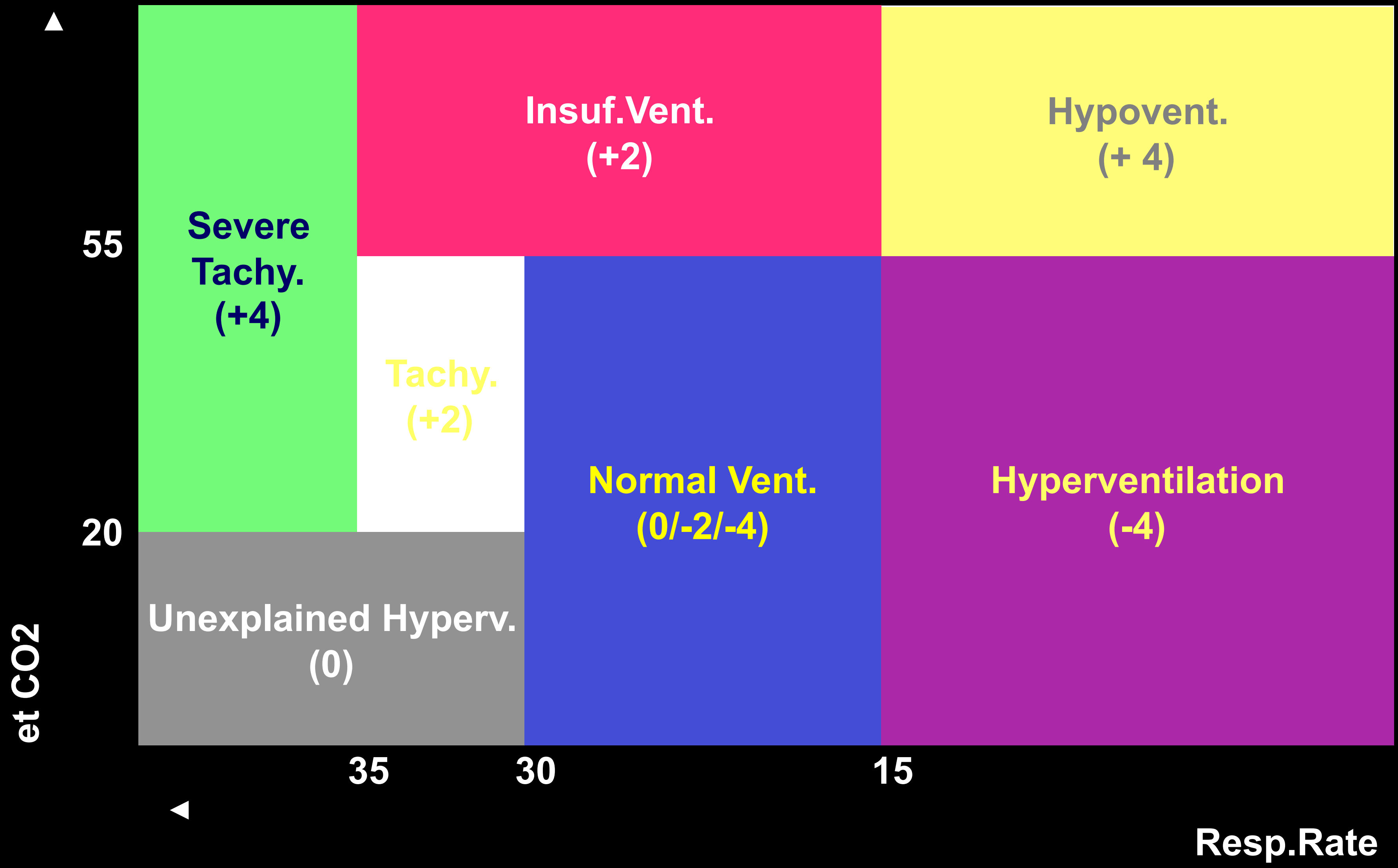
# Ventilation mécanique

- Automatisation ?
  - Diminution de la durée de ventilation mécanique
  - Sevrage respiratoire ?

-Synchronisation ?

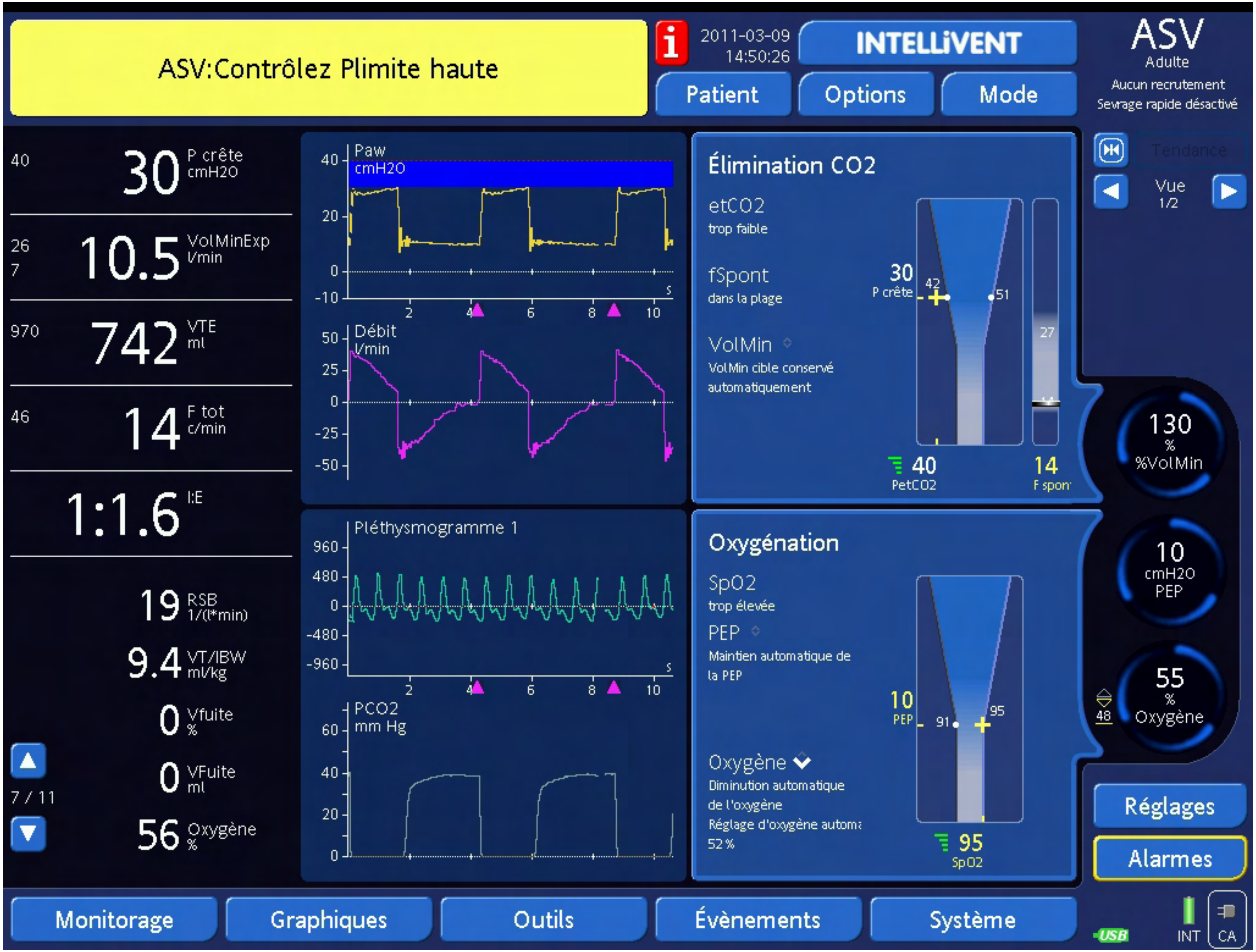
# Modes automatisés

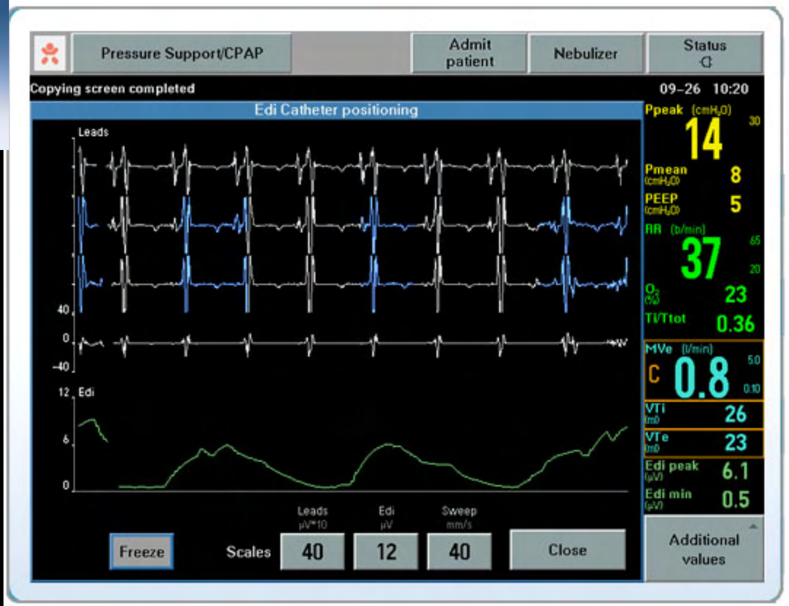
# Fonctionnement du système Smart care

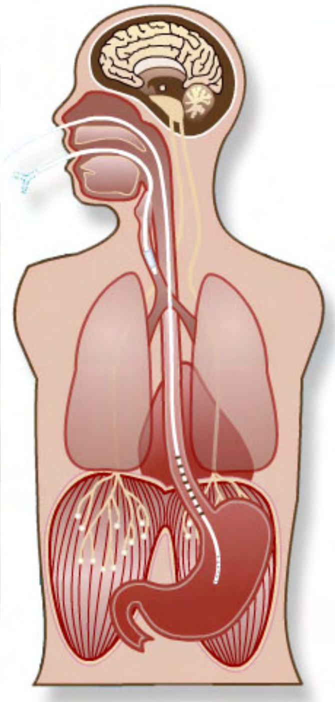


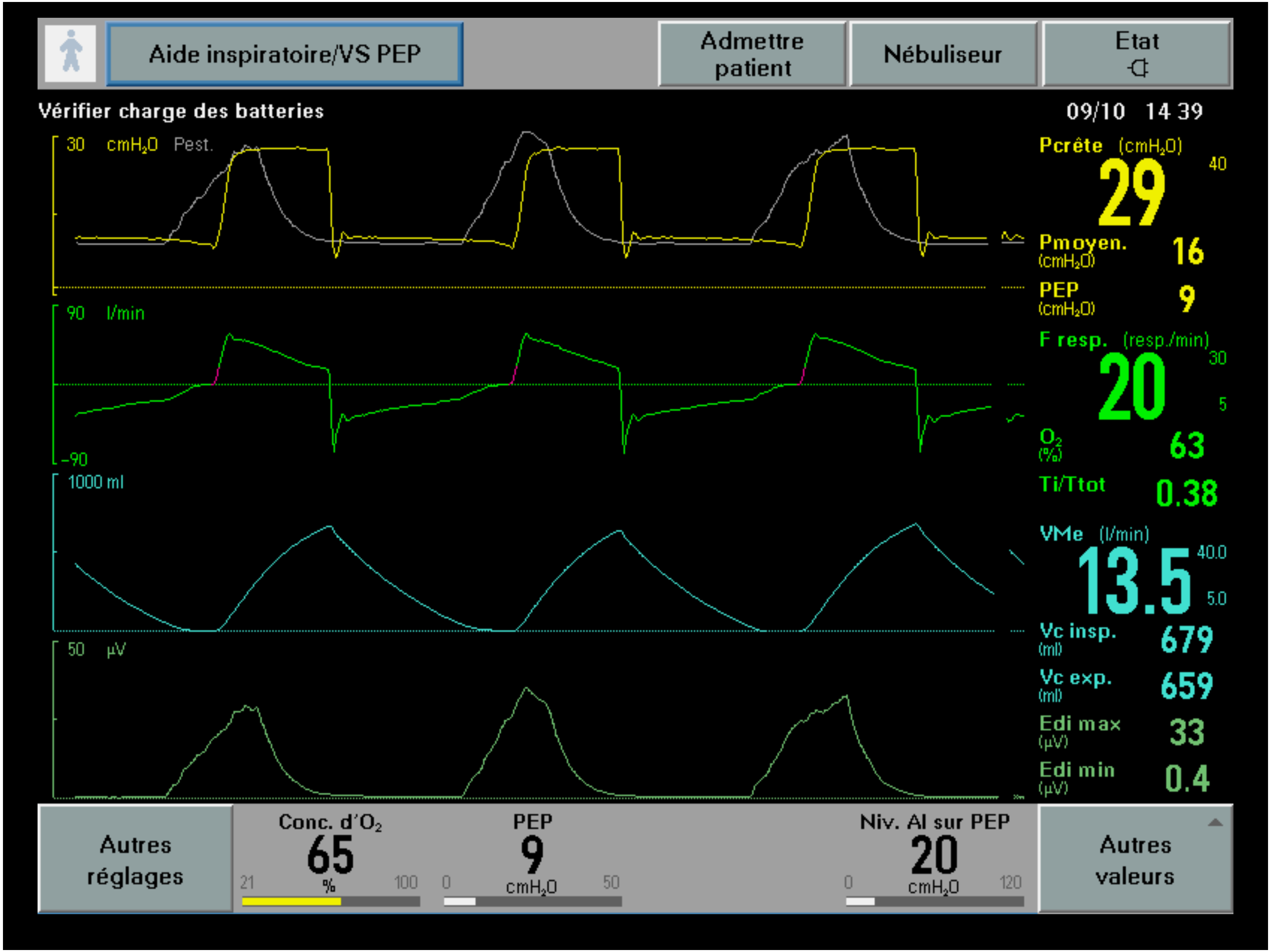
# INTELLI-VENT

- Ventilation « full-automatique »
- Base = ASV
- Réglage de la PEP en fonction de la $SpO_2$
- Réglage de la $FiO_2$ en fonction de la $SpO_2$
- Adaptation PEP/$FiO_2$ en fonction de la VPP
- Réglage Vt et Fr en fonction de la Pet $CO_2$


ASV:Contrôlez Plimite haute
2011-03-09
14:50:26
INTELLiVENT
Patient
Options
Mode
ASV
Adulte
Aucun recrutement
Sevrage rapide désactivé
40
30 P crête cmH2O
26
7
10.5 VolMinExp l/min
970
742 VTE ml
46
14 F tot c/min
1:1.6 I:E
19 RSB 1/(l*min)
9.4 VT/IBW ml/kg
0 Vfuite %
0 VFuite ml
56 Oxygène %
7 / 11
Paw
cmH2O
Débit
l/min
Pléthysmogramme 1
PCO2
mm Hg
Élimination CO2
etCO2
trop faible
fSpont
dans la plage
VolMin
VolMin cible conservé automatiquement
30
P crête
42
51
27
40
PetCO2
14
F spon
Oxygénation
SpO2
trop élevée
PEP
Maintien automatique de la PEP
Oxygène
Diminution automatique de l'oxygène
Réglage d'oxygène autom
52 %
10
PEP
91
95
95
SpO2
Tendance
Vue
1/2
130
%
%VolMin
10
cmH2O
PEP
55
%
Oxygène
48
Réglages
Alarmes
Monitorage
Graphiques
Outils
Évènements
Système
USB
INT
CA


Pressure Support/CPAP
Admit patient
Nebulizer
Status
Copying screen completed
09-26 10:20
Edi Catheter positioning
Leads
Edi
Ppeak
14
Pmean
8
PEEP
5
RR
37
23
Ti/Ttot
0.36
MVe
0.8
VTi
26
VTe
23
Edi peak
6.1
Edi min
0.5
Freeze
Scales
40
12
40
Close
Additional values





Aide inspiratoire/VS PEP
Admettre patient
Nébuliseur
Etat
Vérifier charge des batteries
09/10 14 39
30 cmH2O Pest.
90 l/min
-90
1000 ml
50 µV
Pcrête (cmH2O)
29
40
Pmoyen. (cmH2O)
16
PEP (cmH2O)
9
F resp. (resp./min)
20
30
5
O2 (%)
63
Ti/Ttot
0.38
VMe (l/min)
13.5
40.0
5.0
Vc insp. (ml)
679
Vc exp. (ml)
659
Edi max (µV)
33
Edi min (µV)
0.4
Autres réglages
Conc. d'O2
65
21 % 100
PEP
9
0 cmH2O 50
Niv. AI sur PEP
20
0 cmH2O 120
Autres valeurs

# ***Ces différents modes ….***

- **Efficacité ?**
- **Tolérance ?**
- **Synchronisation ?**
- **Coût ?**
- **Complications ?**
- **Intubation ?**
- **Mortalité ?**
- **Durée de séjour aux soins intensifs ?**

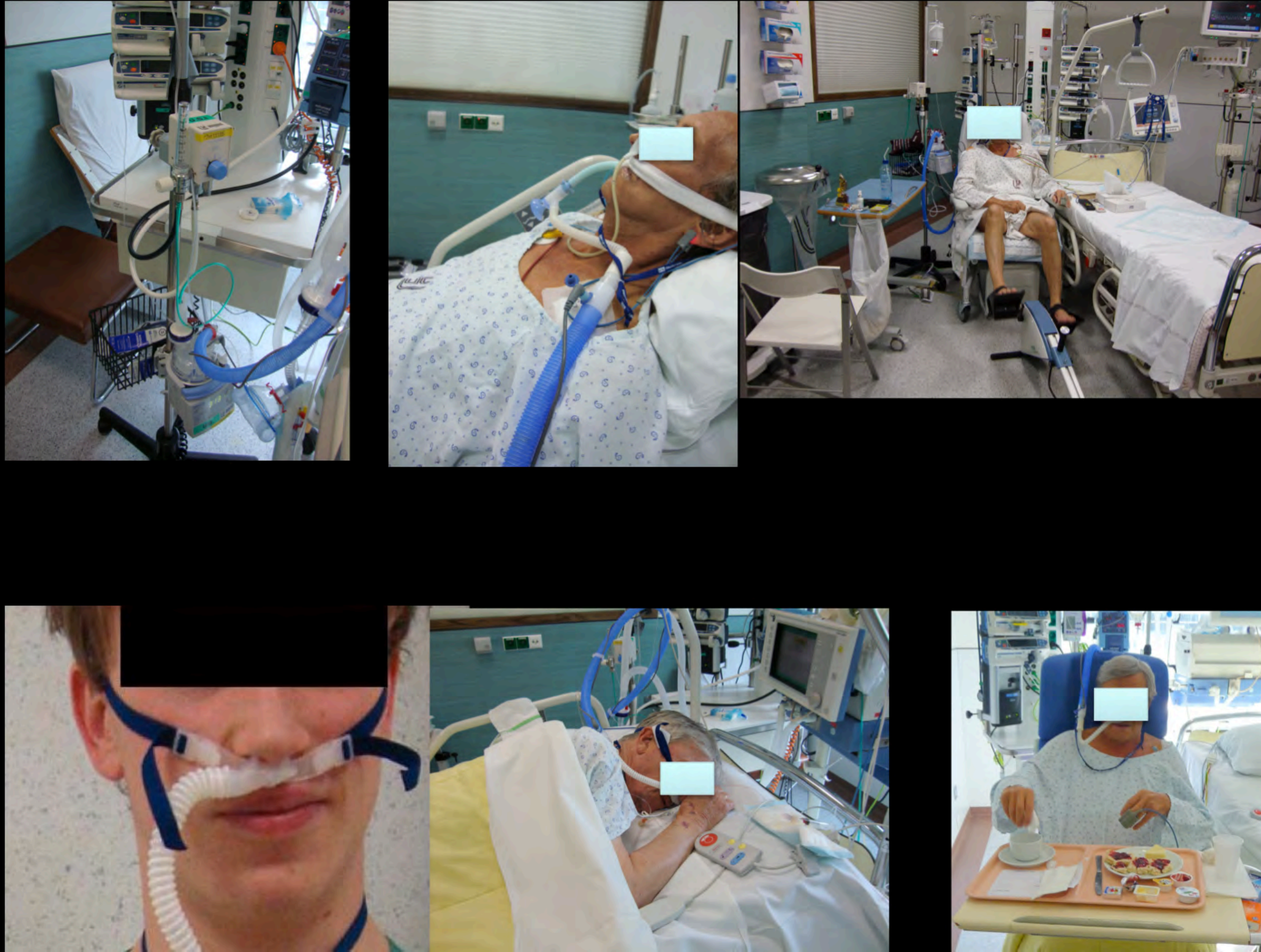
# Intérêt dans la prévention de la PAV

- Positionnement du patient ?
- A.E.T. systématique ?
- Sevrage précoce suivi de V.N.I.
- …..


Gattinoni
Guérin
Mancebo
JC Richard

- Bien tolérée
- Moins de sédation
- Possibilité de nutrition par rapport au D.V.

- Héliox
- Techniques Instrumentales
- Aérosolthérapie
- V.N.I.
- Ventilation mécanique
- Oxygénothérapie à haut débit
- Mobilisation précoce



# ETUDE FLORALI

Etude prospective, randomisée, multicentrique, contrôlée

- Tolérance
- Amélioration de l’oxygénation
- Diminution du nombre d’intubation dans l’I.R.A.
- Coût

- Héliox
- Techniques Instrumentales
- Aérosolthérapie
- V.N.I.
- Ventilation mécanique
- Oxygénothérapie à haut débit
- Mobilisation précoce

# Technologies

Research

Open Access

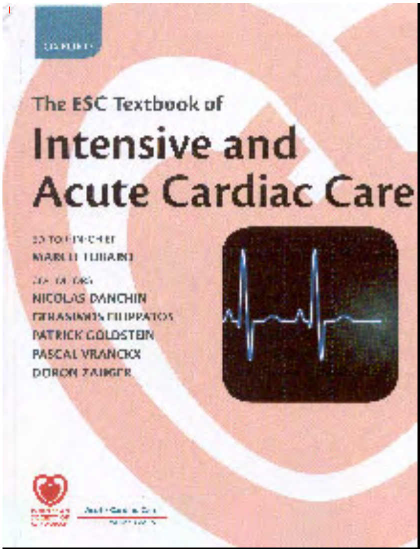
# Electrical muscle stimulation preserves the muscle mass of critically ill patients: a randomized study

Vasiliki Gerovasili[1], Konstantinos Stefanidis[1], Konstantinos Vitzilaios[1], Eleftherios Karatzanos[1], Panagiotis Politis[1], Apostolos Koroneos[1], Aikaterini Chatzimichail[2], Christina Routsi[1], Charis Roussos[1] and Serafim Nanas[1]

*Critical Care* 2009, **13**:R161 (doi:10.1186/cc8123)
This article is online at: http://ccforum.com/content/13/5/R161


**Key messages**

- CIPNM is a common complication of critical illness, for which no preventive or therapeutic tool has been reported so far
- EMS is well tolerated and seems to preserve the muscle mass of critically ill patients
- Further studies are needed to evaluate whether EMS can also preserve muscle structure and function and eventually prevent CIPNM




CHAPTER 32

## Physiotherapy in critically ill patients

R. Gosselink and J. Roeseler

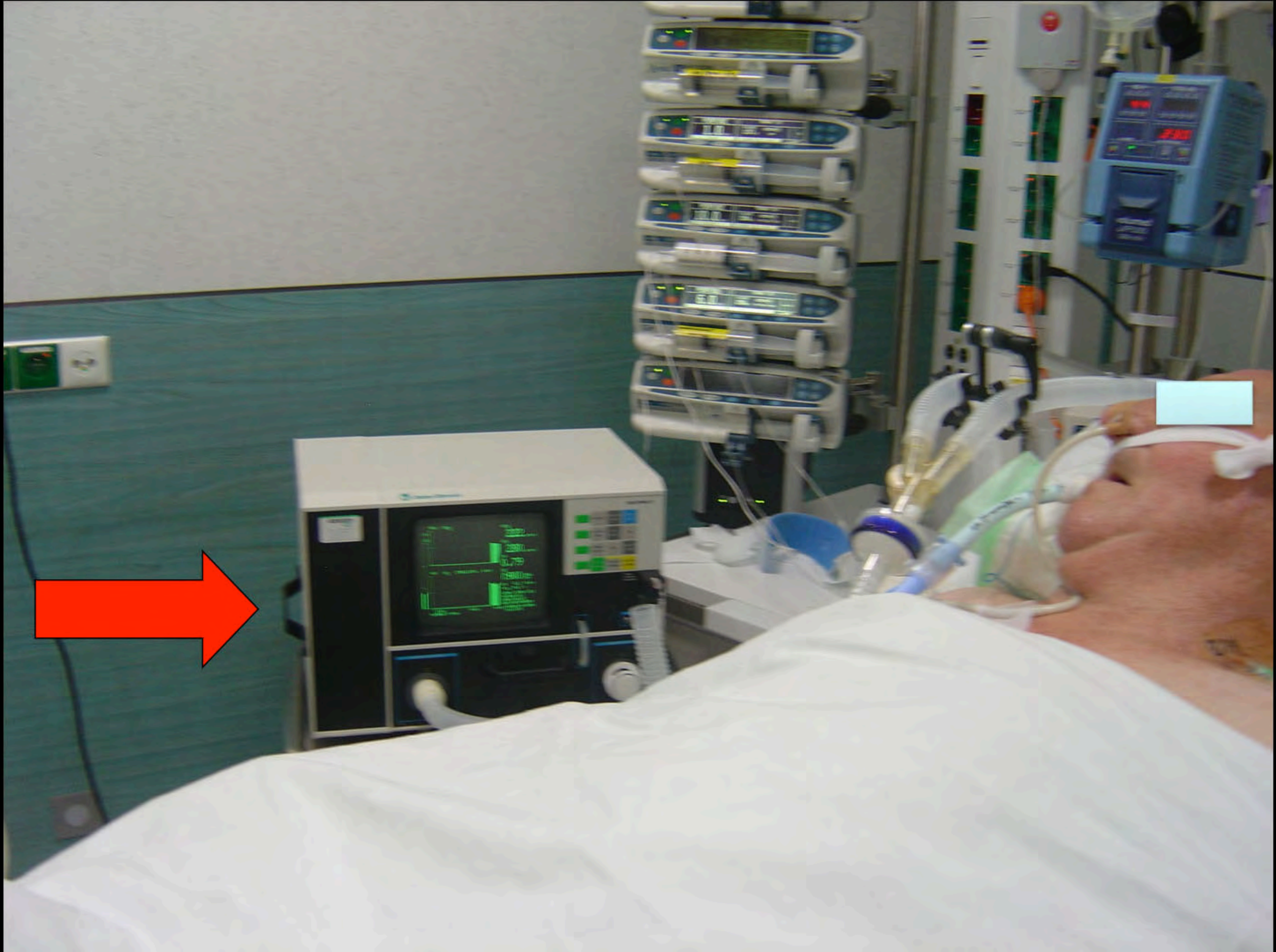
R. Gosselink
J. Bott
M. Johnson
E. Dean
S. Nava
M. Norrenberg
B. Schönhofer
K. Stiller
H. van de Leur
J. L. Vincent

Intensive Care Med (2008) 34:1188–1199

**Physiotherapy for adult patients with critical illness: recommendations of the European Respiratory Society and European Society of Intensive Care Medicine Task Force on Physiotherapy for Critically Ill Patients**

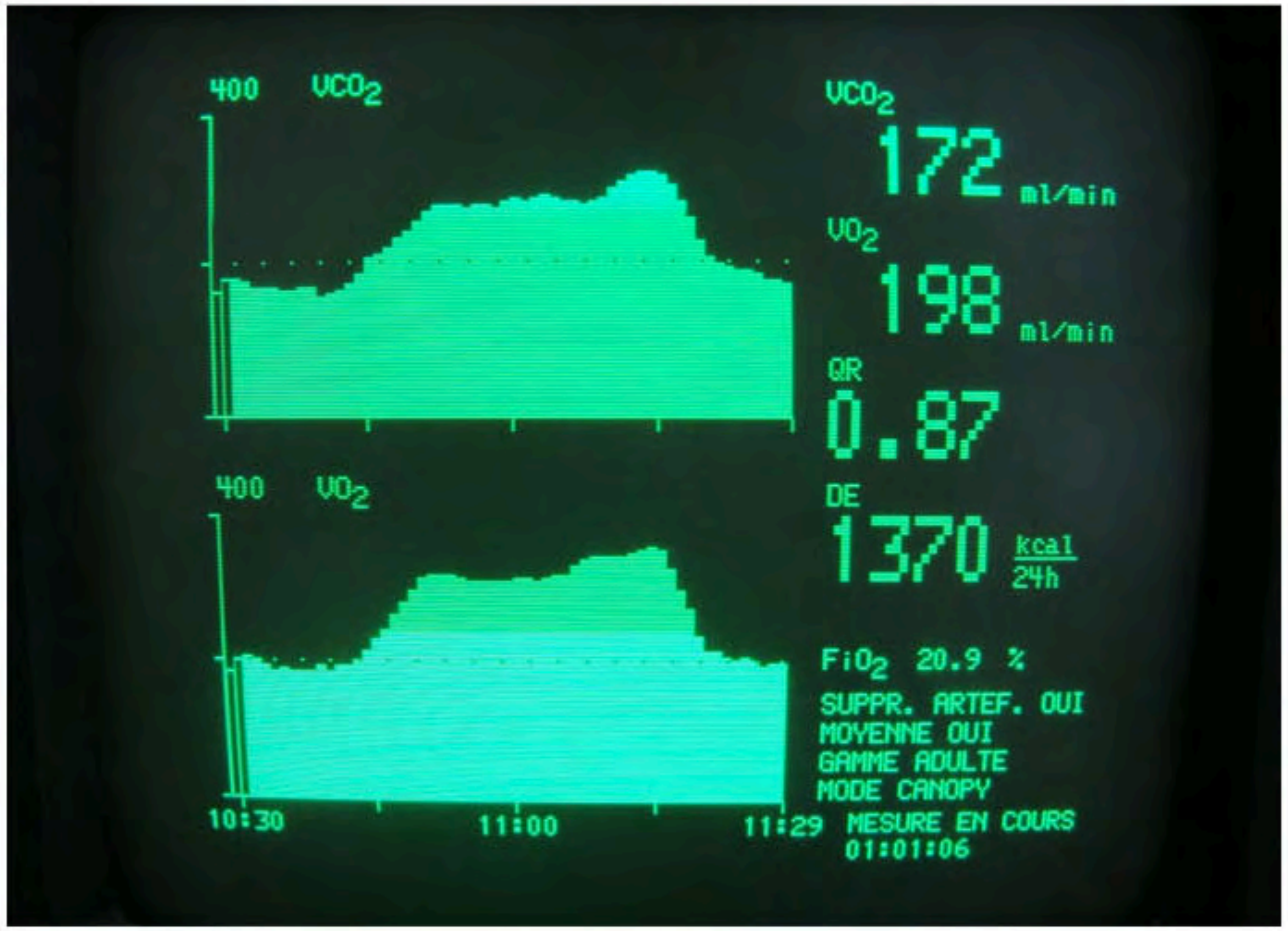
Evidence-based targets for physiotherapy are deconditioning, impaired airway clearance, atelectasis, avoidance of (re-)intubation, and weaning failure. Early physical activity and mobility are key in the prevention, attenuation, or reversion of physical deconditioning related to critical illness. A variety of modalities for exercise training and early mobility are evidence based and are implemented depending on the stage of critical illness, comorbid conditions, and cooperation of the patient.

The physiotherapist should be responsible for implementing mobilization plans and exercise prescription and make recommendation for progression for progression of these jointly with medical and nursing staff.



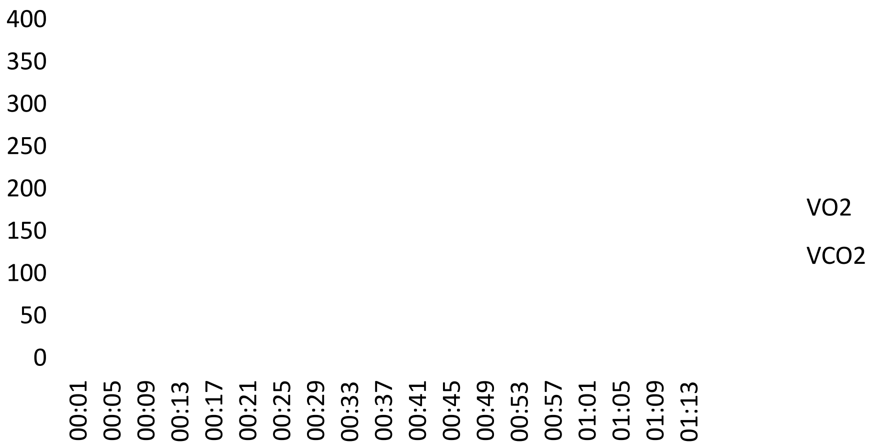
- **Nutrition optimale**

  - Adaptation en fonction de la dépense énergétique

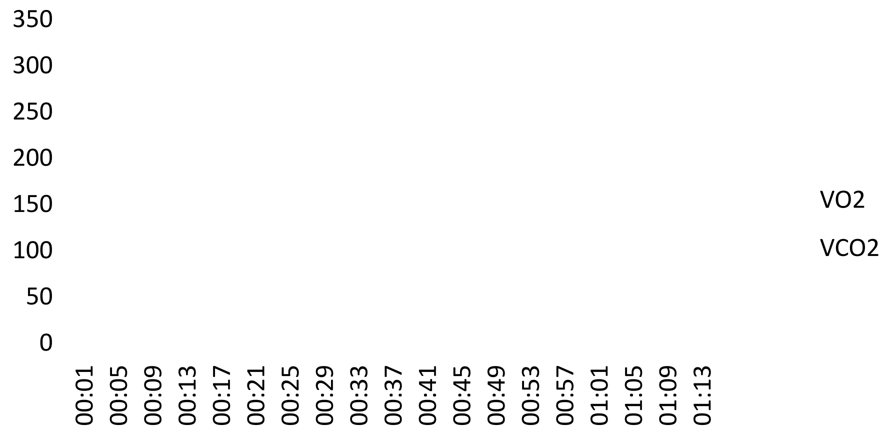

400 VCO2
VCO2
172 ml/min
VO2
198 ml/min
QR
0.87
400 VO2
DE
1370 kcal/24h
FiO2 20.9 %
SUPPR. ARTEF. OUI
MOYENNE OUI
GAMME ADULTE
MODE CANOPY
10:30
11:00
11:29
MESURE EN COURS
01:01:06

# Calorimétrie indirecte

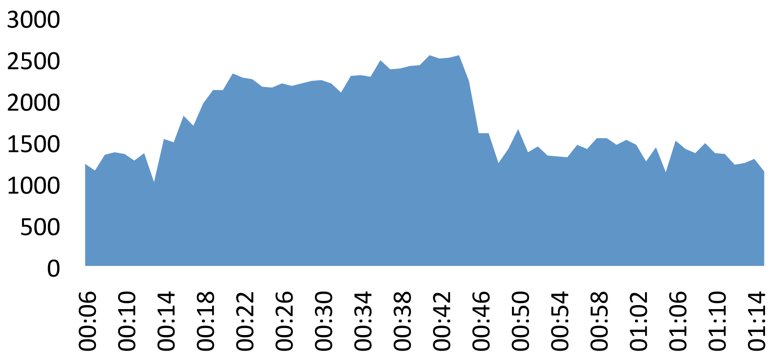
## Exercice actif



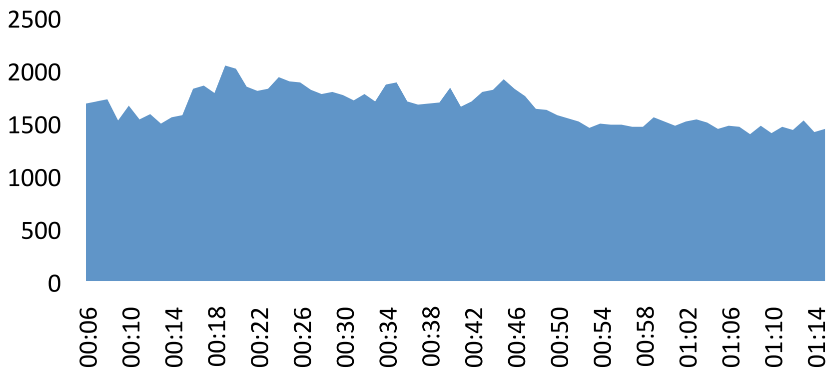

## Exercice passif




## Global DE kcal/24hr




## Global DE kcal/24hr




MERCI POUR VOTRE ATTENTION

**Des chercheurs qui cherchent … on en trouve**

**Mais…..des chercheurs qui trouvent….**

**on en cherche encore …**