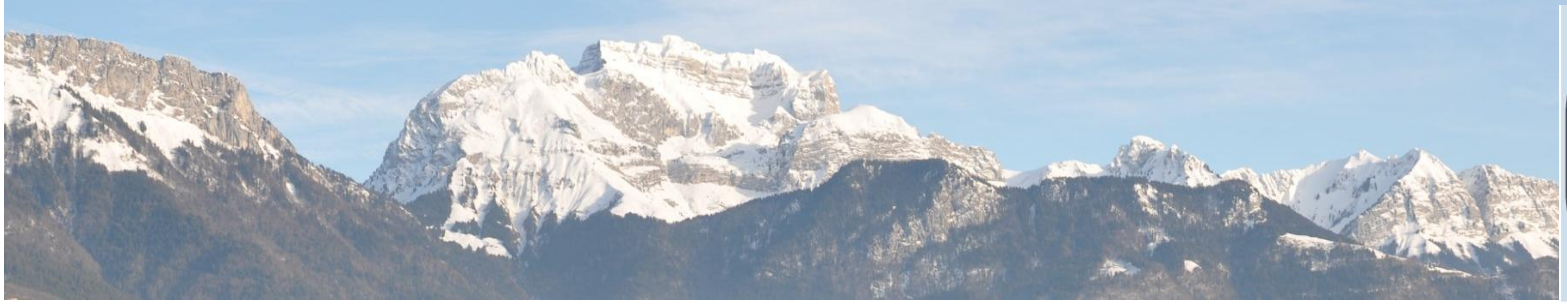


MODALITES VENTILATOIRES PENDANT LE MASSAGE CARDIAQUE

Jean-Christophe M Richard, MD PhD

Pôle SAMU 74 Urgence et Réanimation Centre Hospitalier Annecy Genevois
INSERM UMR 955 Eq13

CONFLICTS OF INTEREST

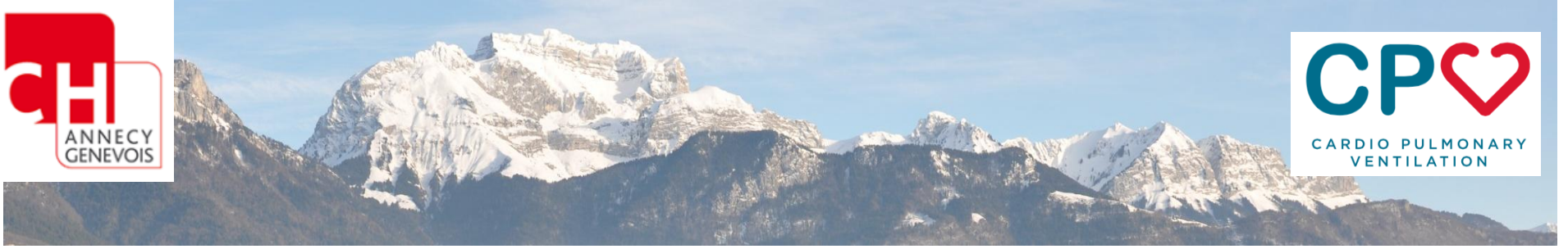
Part Time:

Air Liquide Medical Systems

SAMU, ICU and Emergency department Annecy General Hospital

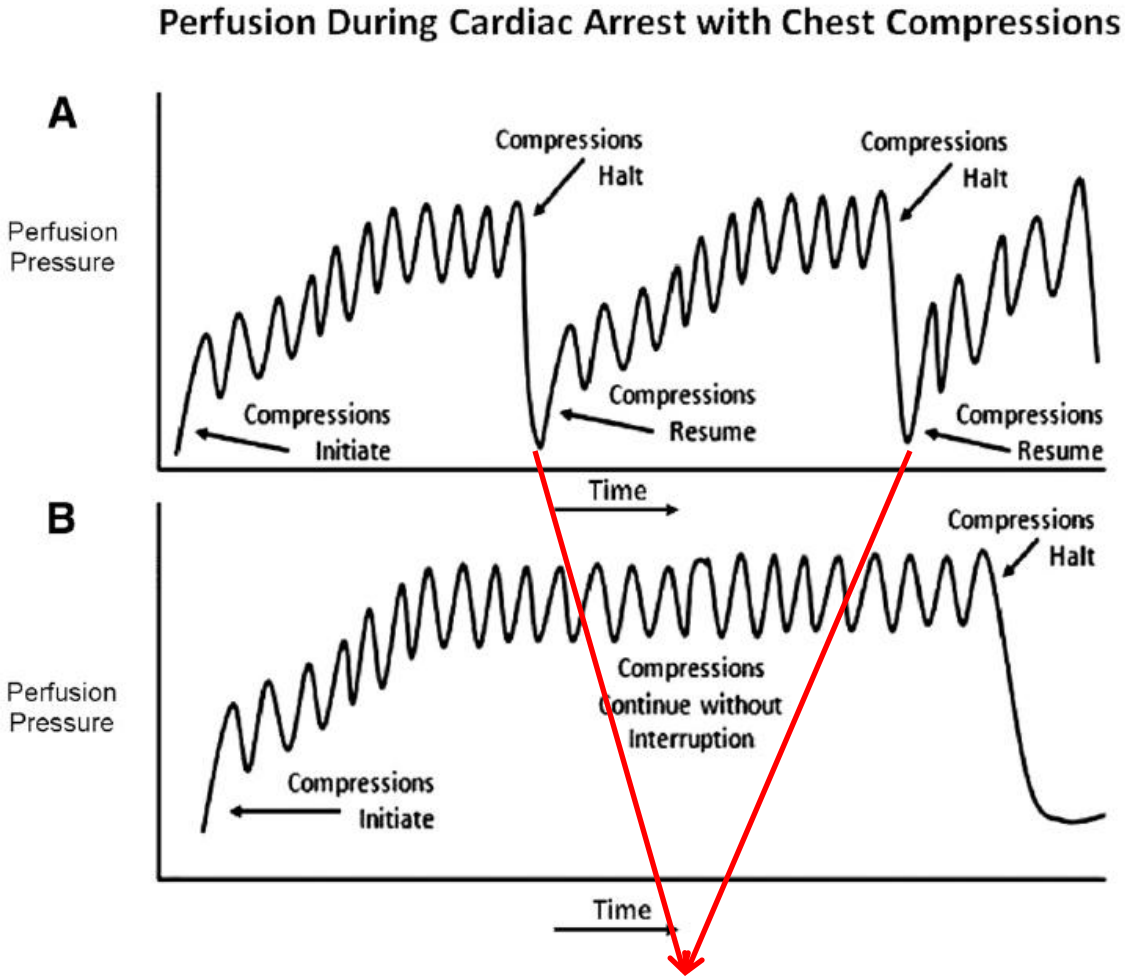
Research from our laboratory in Geneva was supported:

- VYGON
- MAQUET (NAVA)
- COVIDIEN (PAV+)
- DRAGER (SmartCare)
- GE (FRC)



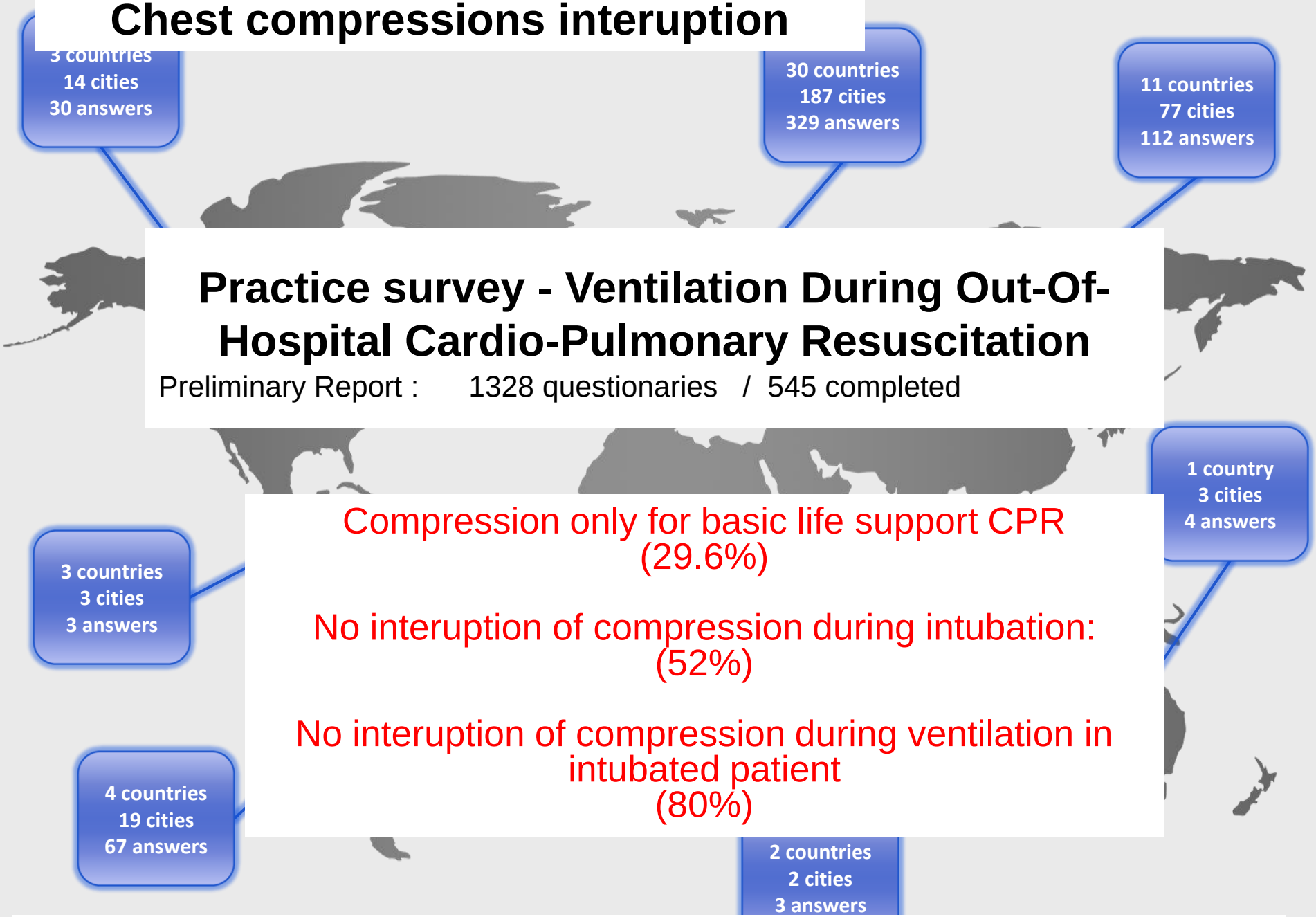
Pour quelles raisons la ventilation peut-elle être délétère pendant la RCP ?

Risks associated with chest compressions interuption



Ventilation/Fatigue/ Rythme Analyses

Chest compressions interuption



Practice survey - Ventilation During Out-Of-Hospital Cardio-Pulmonary Resuscitation

Preliminary Report : 1328 questionaries / 545 completed

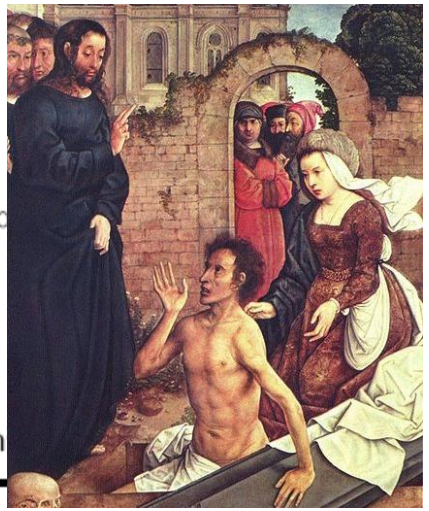
Compression only for basic life support CPR (29.6%)

No interuption of compression during intubation: (52%)

No interuption of compression during ventilation in intubated patient (80%)

R Cordioli, L Suppan, F Templier, D Savary, S Delisle, A Khoury, L Brochard and JC Richard

Risks associated with Hyperventilation



JOURNAL OF THE ROYAL SOCIETY OF MEDICINE Volume 100

EWS

The Lazarus phenomenon

Vedamurthy Adhiyaman[1] Sonja Adhiyaman[2] Radha Sundaram

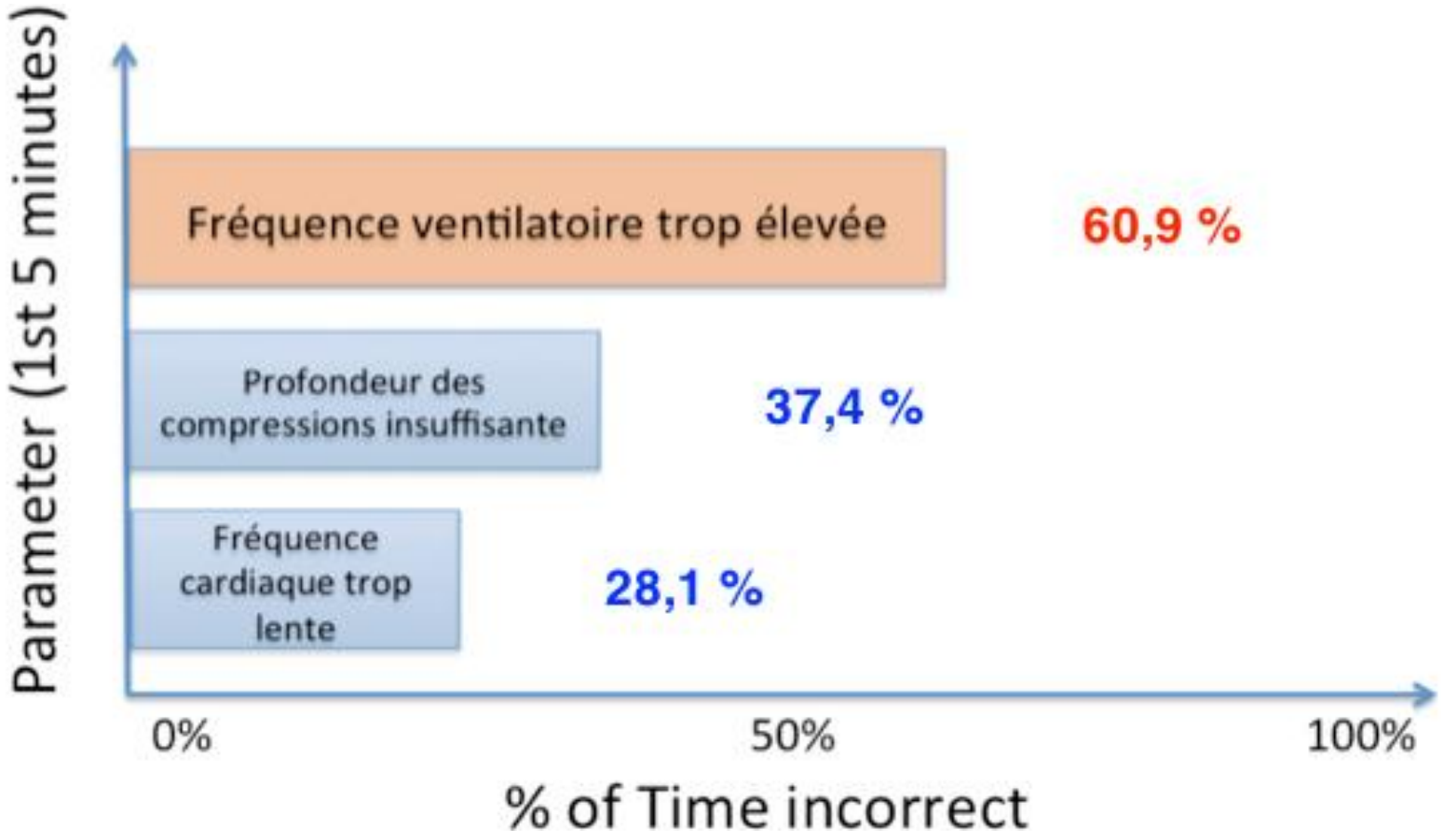
J R Soc Med 2007;**100**:552–557

Even though Lazarus phenomenon is rare, it is probably under reported. There is no doubt that Lazarus phenomenon is a reality but so far the scientific explanations have been inadequate. So far the only plausible explanation at least in some cases is auto-PEEP and impaired venous return. In

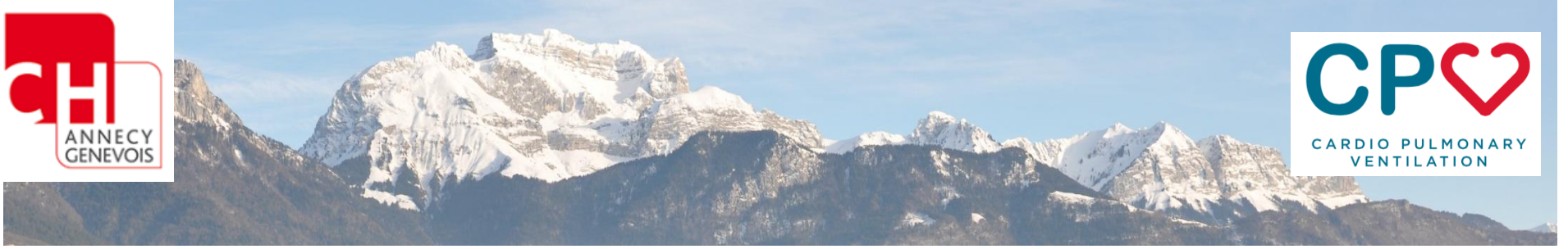
considered as a cause and a short period of apnoea (30–60 seconds) should be tried before stopping resuscitation. Since ROSC occurred within 10 minutes in most cases, patients should be passively monitored for at least 10 minutes after the cessation of CPR before confirming death.

eight had obstructive airways dis include ruptured abdominal aortic artery rupture, gastrointestinal haem due to renal failure, trauma, digox overdose with opiates and cocaine.

HARMFUL EFFECTS OF HYPER VENTILATION



JAMA 2005



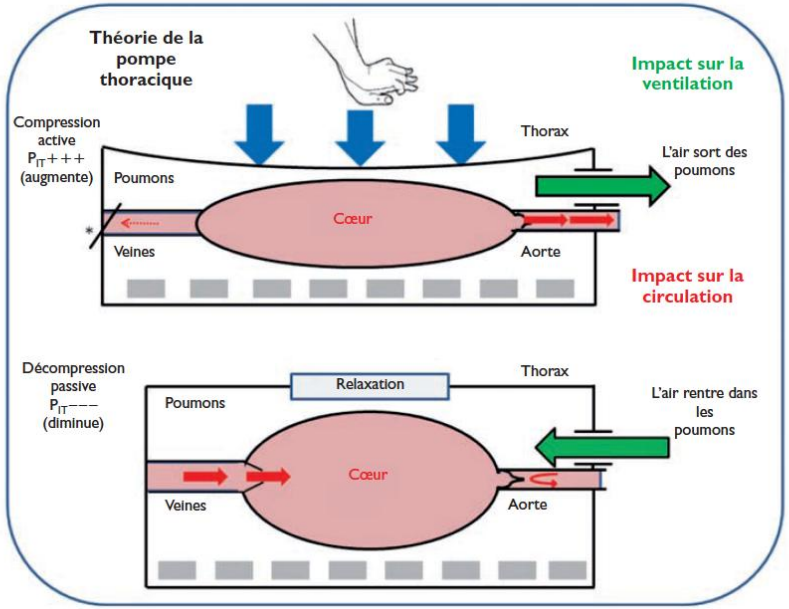
Comment ça marche ?

Cardiopulmonary resuscitation : risks and benefits of ventilation

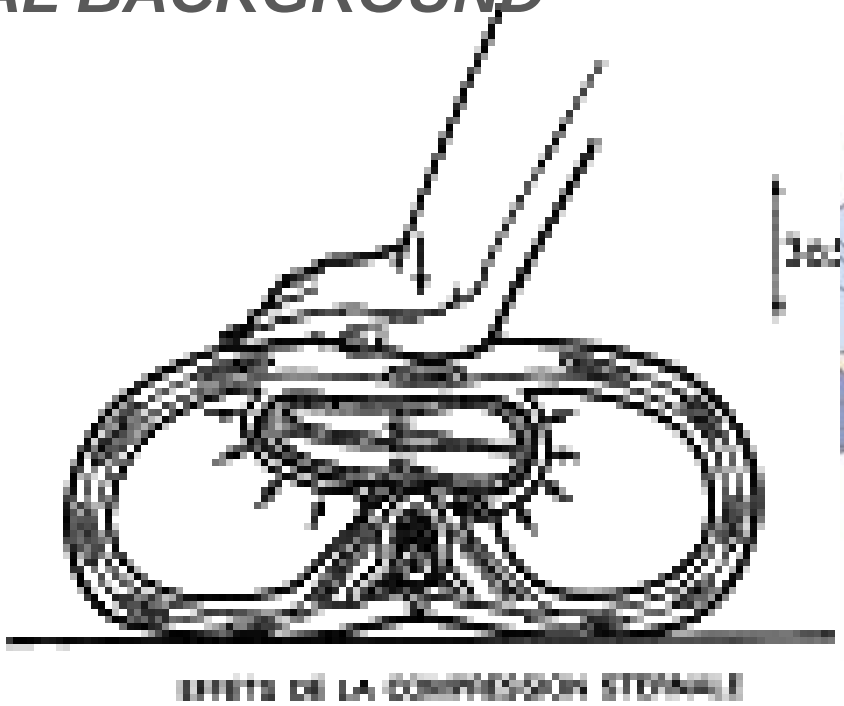
Knowledge of the physiological mechanisms that govern cardiopulmonary interactions during cardiopulmonary resuscitation (CPR) allows to better assess risks and benefits of ventilation. Ventilation is required to maintain gas exchange, particularly when CPR is prolonged. Nevertheless, conventional ventilation (bag mask or mechanical ventilation) may be harmful when excessive or when chest compressions are interrupted. In fact large tidal volume and/or rapid respiratory rate may adversely compromise hemodynamic effects of chest compressions. In this regard, international recommendations that give the priority to chest compressions, are meaningful. Continuous flow insufflation with oxygen that generates a moderate positive airway pressure avoids any interruption of chest compressions and prevents the risk of lung injury associated with prolonged resuscitation.

Rev Med Suisse 2013; 9: 2318-23

R. L. Cordioli
V. Garelli
A. Lyazidi
L. Suppan
D. Savary
L. Brochard
J.-C. M. Richard



PHYSIOLOGICAL BACKGROUND



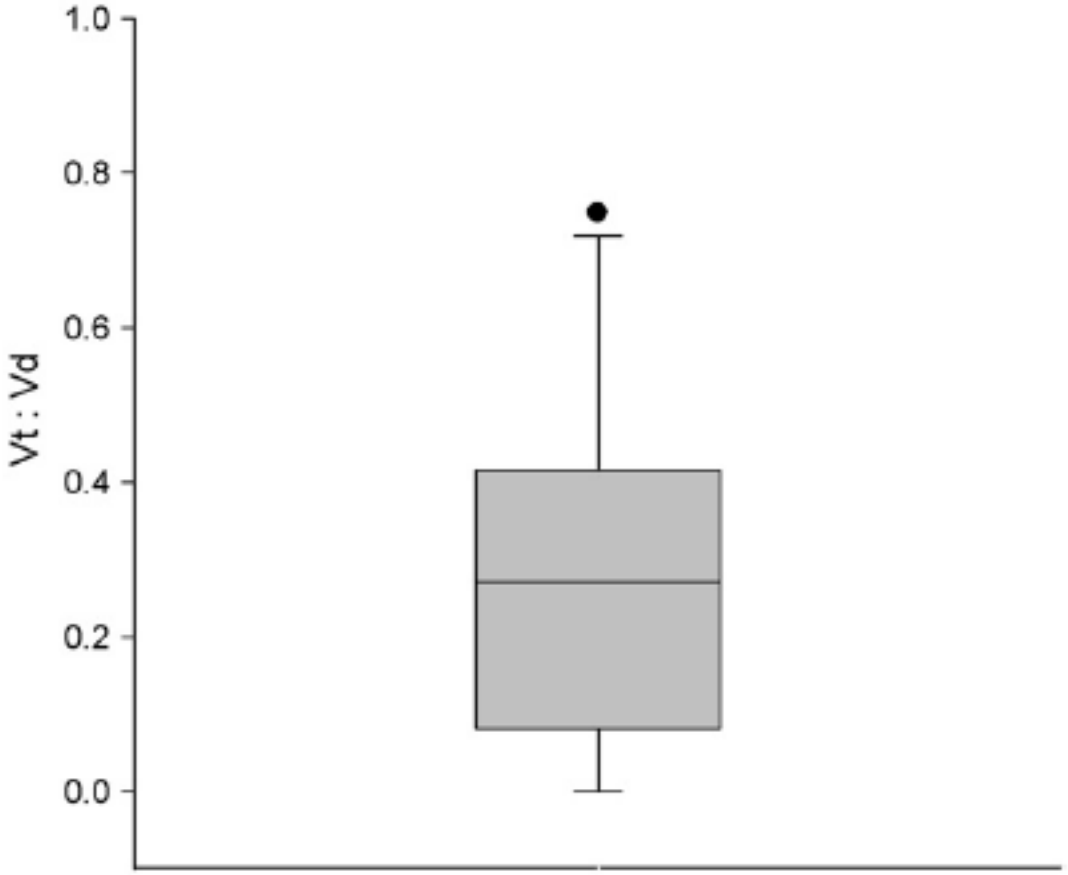
Blood circulation
Cardiac output

Lung volume displacement
Ventilation

Does compression-only cardiopulmonary resuscitation generate adequate passive ventilation during cardiac arrest?☆

Charles D. Deakin[a,*], John F. O'Neill[b], Ted Tabor[c]

RESUSCITATION

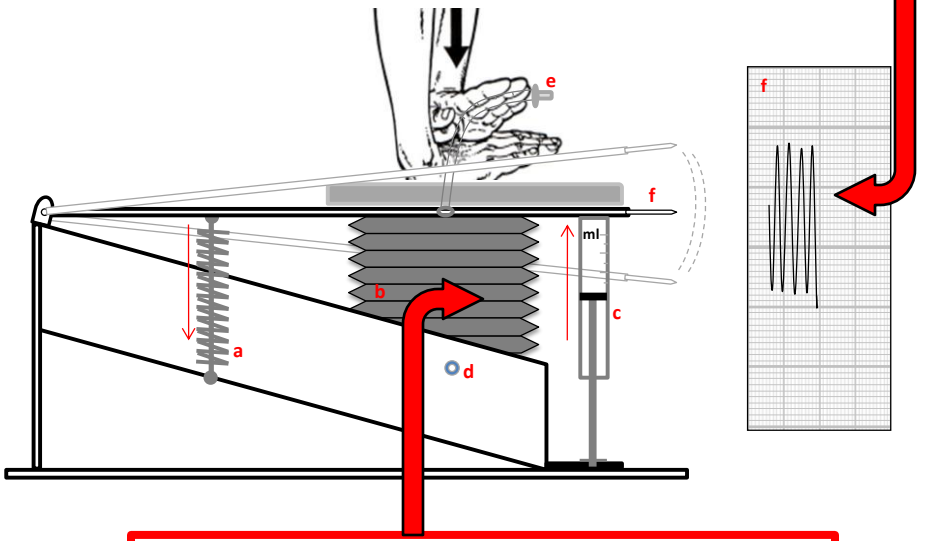


J Appl Physiol 120: 000–000, 2016.
First published November 19, 2015; doi:10.1152/japplphysiol.00632.2015.

Impact of ventilation strategies during chest compression. An experimental study with clinical observations

Ricardo L. Cordioli[1,2,3], Aissam Lyazidi[1,4,5] Nathalie Rey[6], Jean-Max Granier[1], Dominique Savary[7], Laurent Brochard [8,9,10], Jean-Christophe M Richard[7,10]

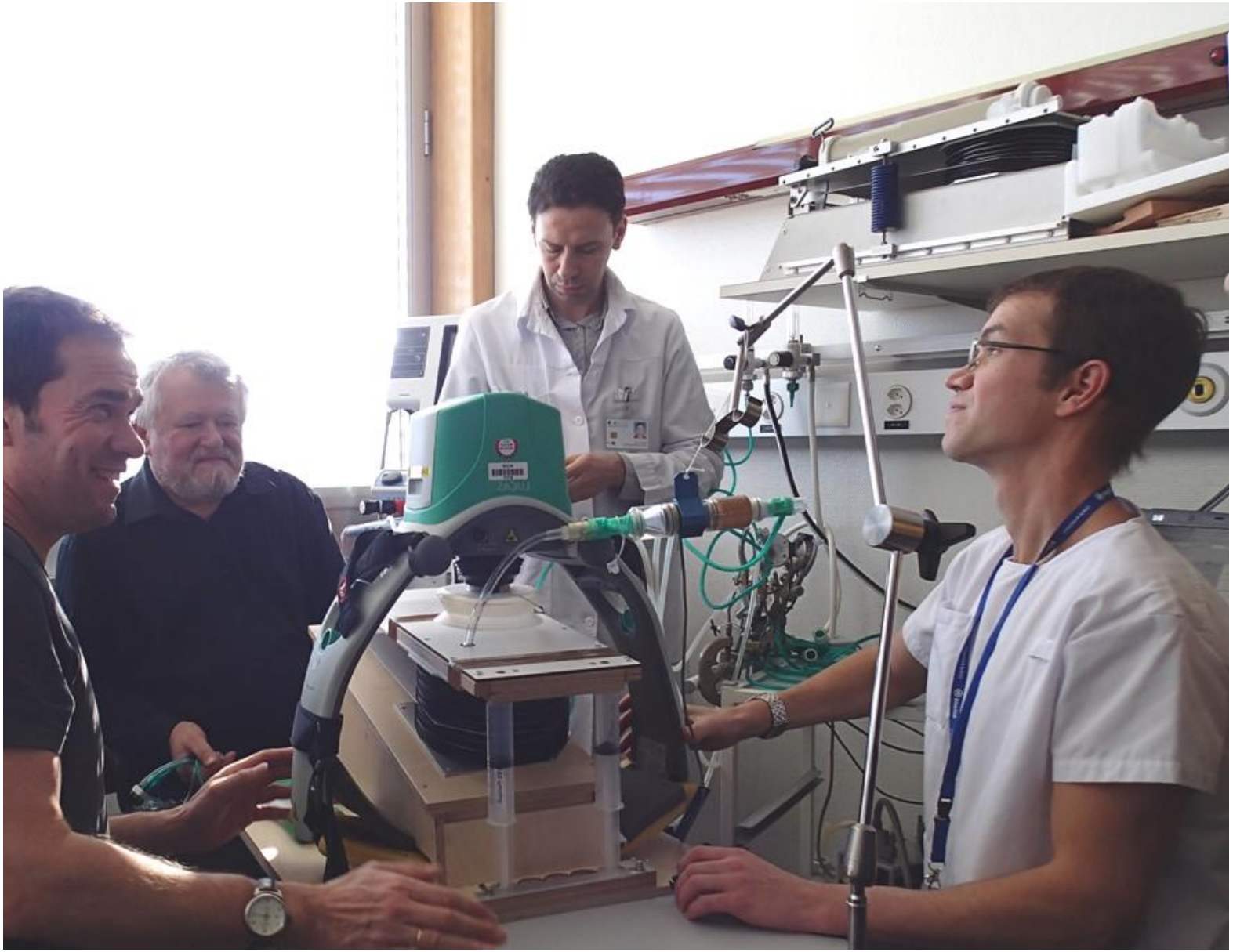
Change in lung volume: Vt and FRC



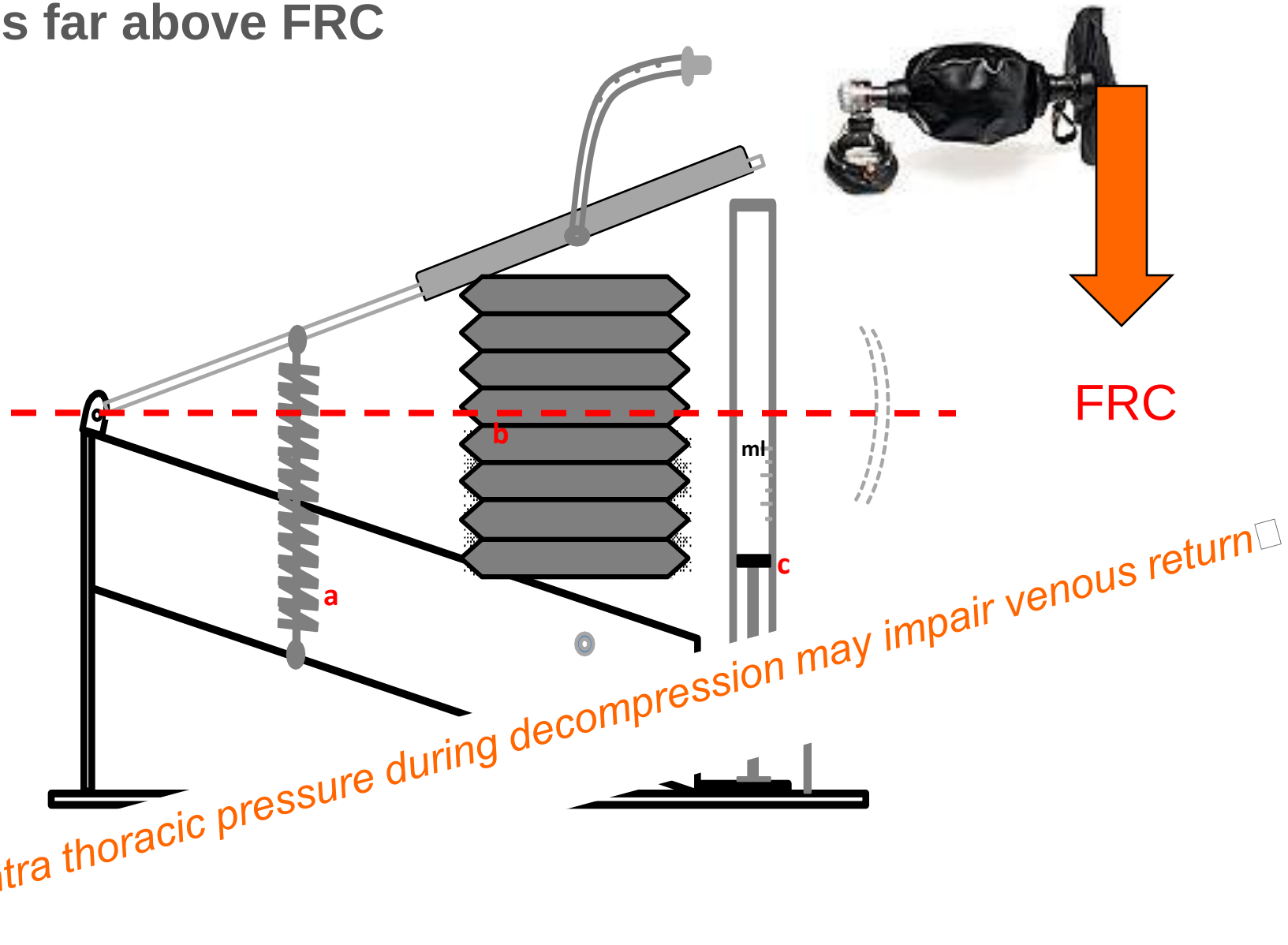
a. Ressort
b. Soufflet
c. Seringue
d. Prise de pression dans le soufflet
e. Entré d'air
f. Stylet et Papier millimétrique

Pressure transmitted into the thoracic compartment

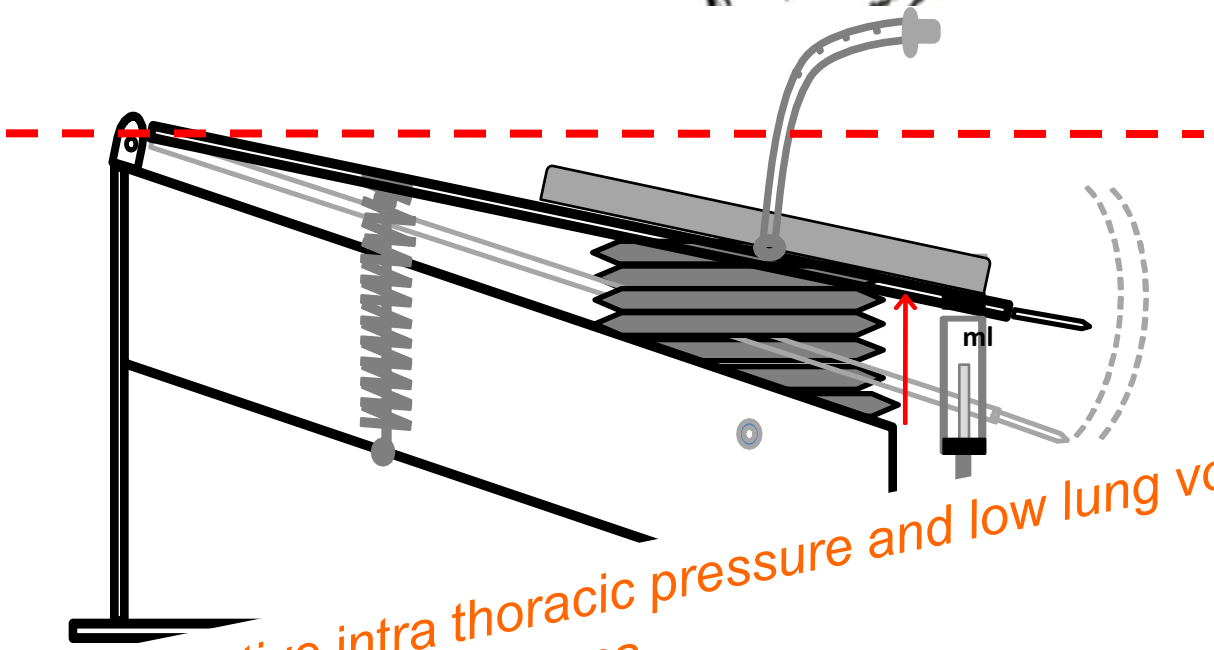
aps American Physiological Society Journal of Applied Physiology



Adverse effects expected with increase in lung volumes far above FRC

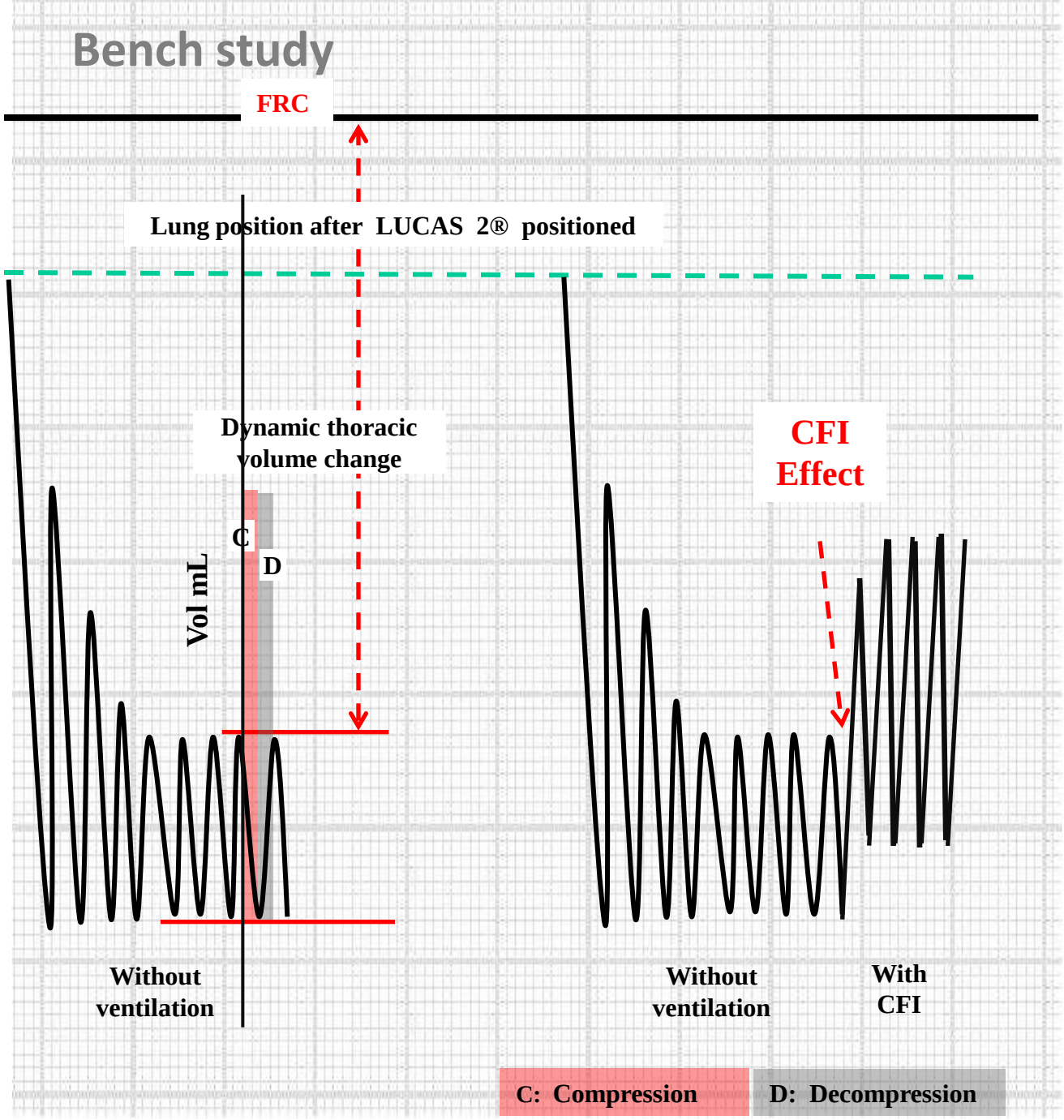


Adverse effects expected with reduction in lung volumes far below FRC

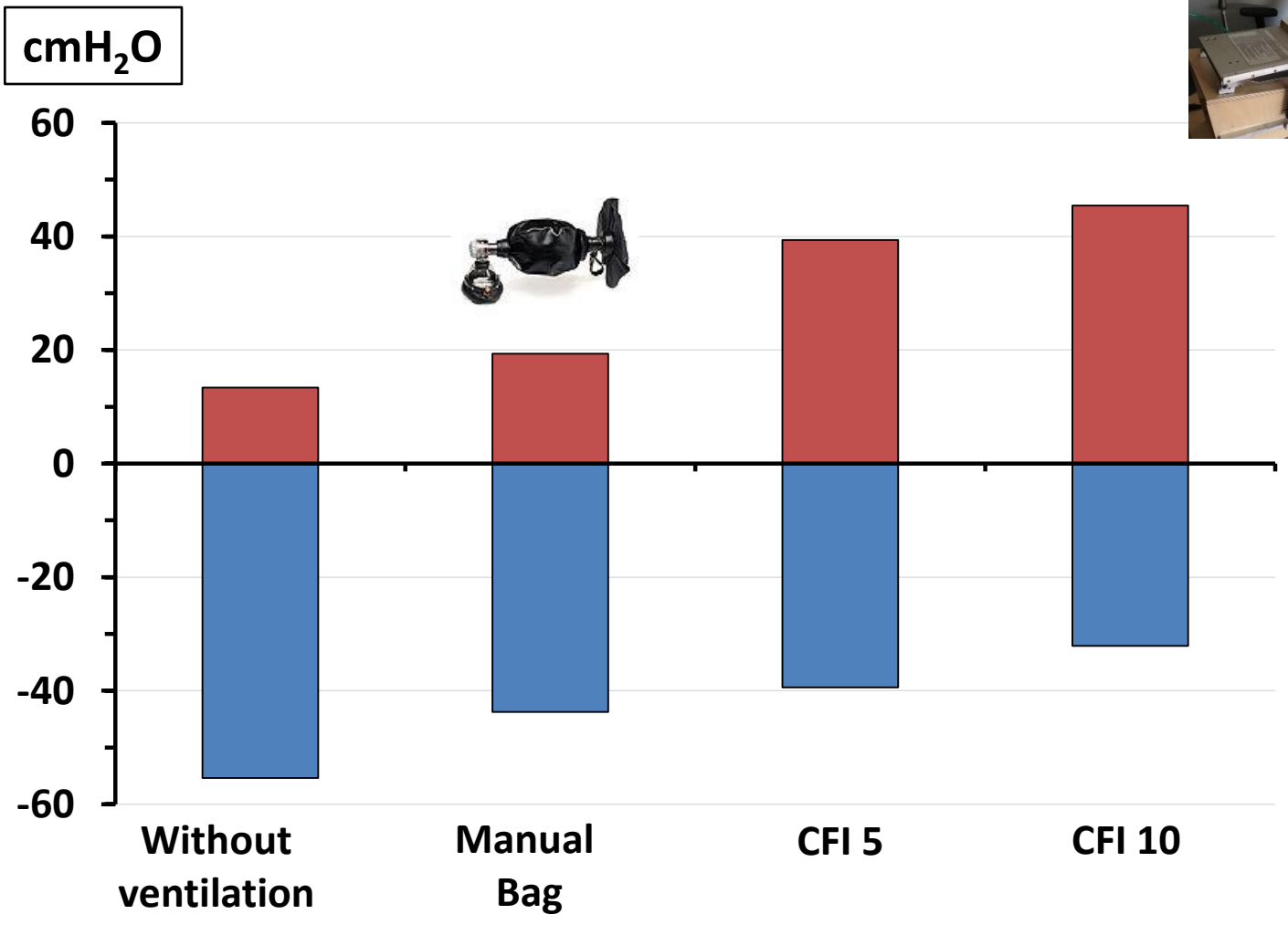


FRC

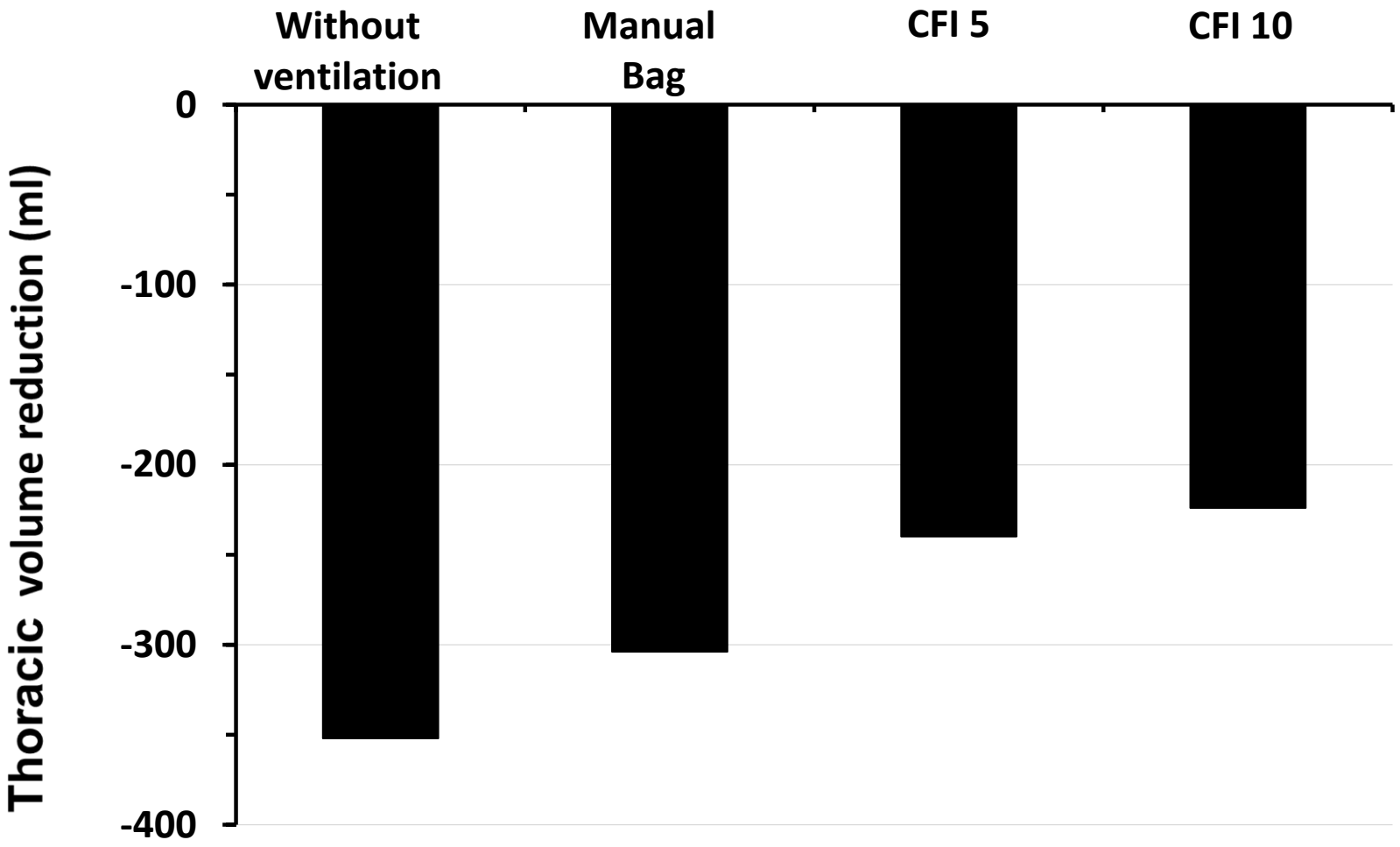
Negative intra thoracic pressure and low lung volume favor lung injury and edema


Bench study
FRC
Lung position after LUCAS 2® positioned
Dynamic thoracic volume change
Vol mL
C
D
CFI Effect
Without ventilation
Without ventilation
With CFI
C: Compression
D: Decompression

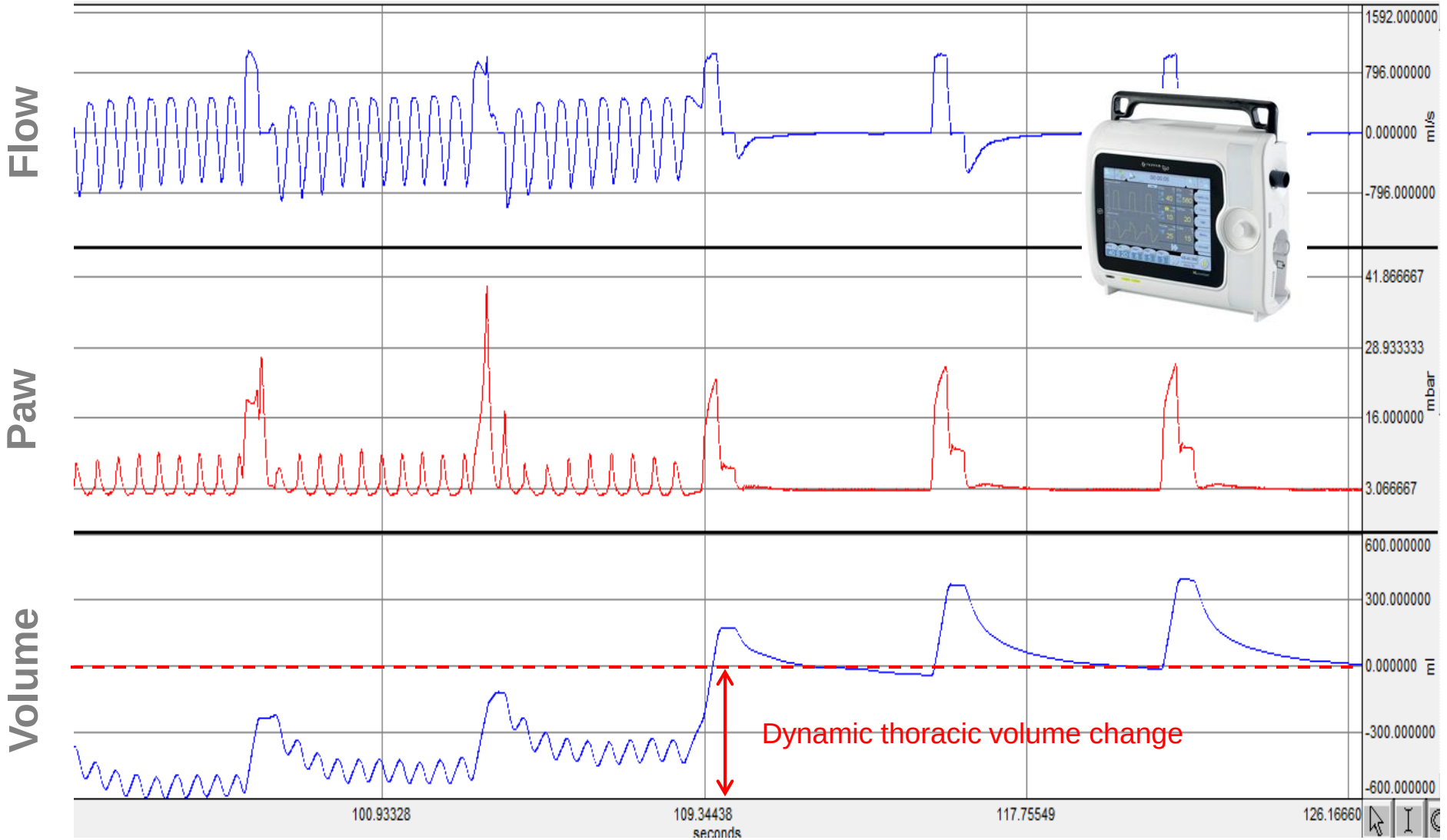
RESULTS PRESSURE WITH CFI 5



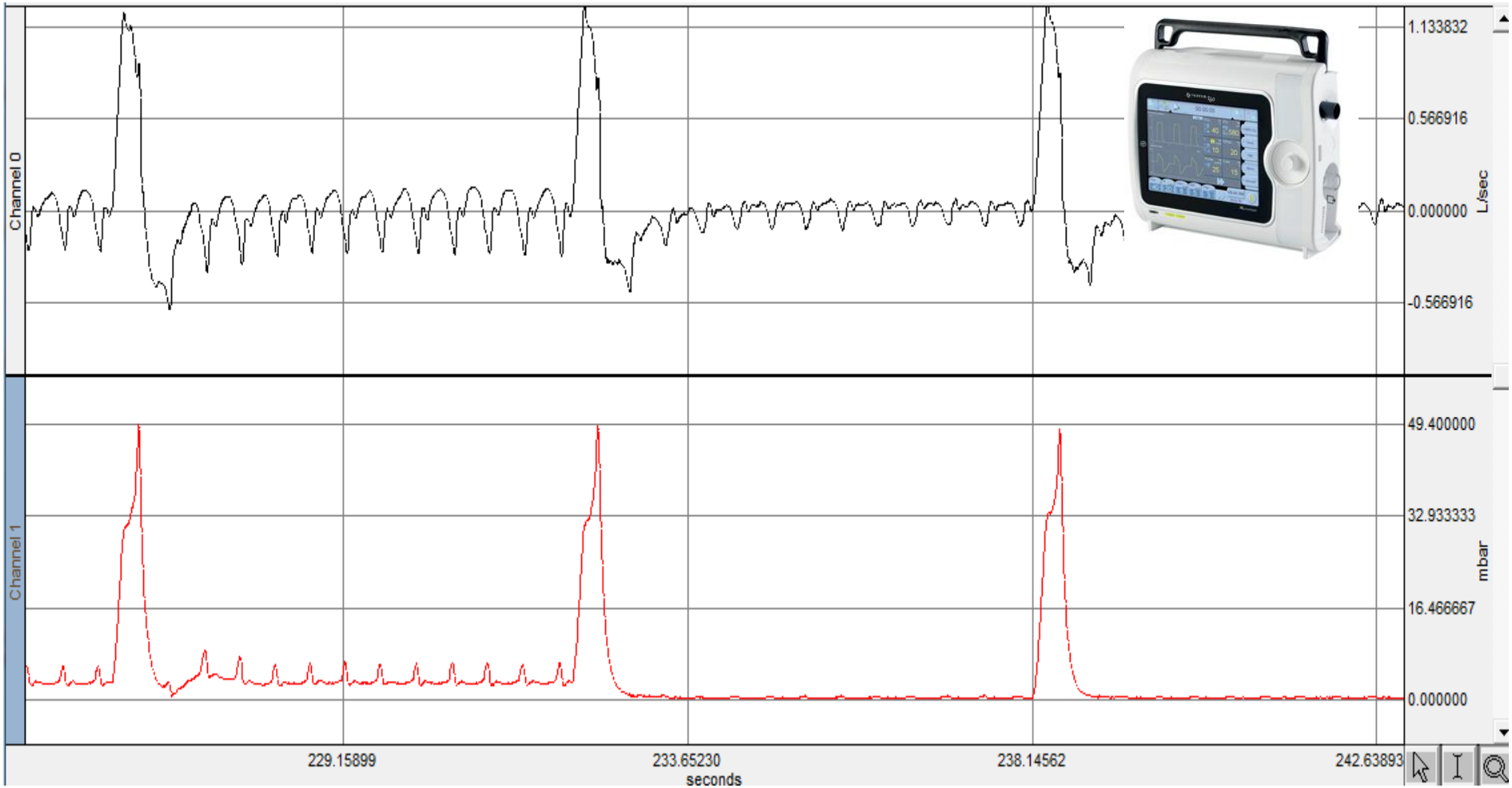
RESULTS WITH CFI 5



Clinical observation:
Reduction in lung volume below FRC during chest compressions

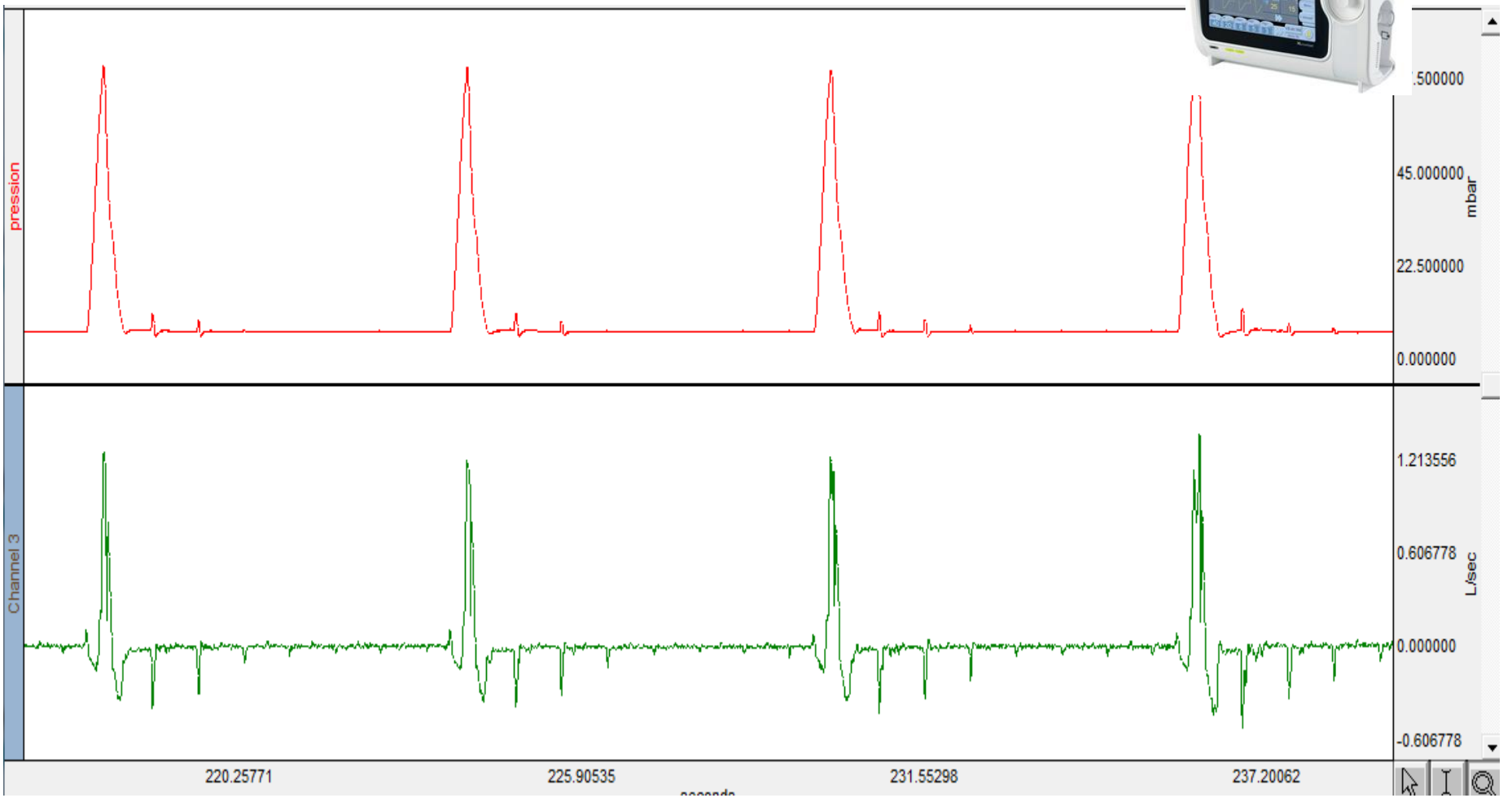


Clinical observation:
Airways collapse related to PEEP reduction



Change in intra thoracic pressure is no longer transmitted to Paw

Clinical observation:
Automatic chest compression device



CARDIO PULMONARY VENTILATION: SPECIFICATIONS

① Compliant adaptable to international recommendations

② Avoid harmful effect of conventional ventilation

③ Magnify pressure transmission to circulation

④ To cover automatically BLS to ALS (mask or intubation)

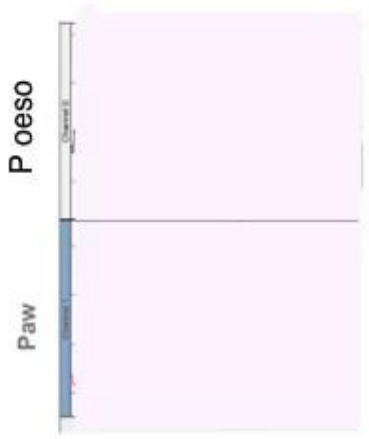
⑤ To permit simple and efficient monitoring for CPR


CPV
CARDIO PULMONARY VENTILATION
EXT
00:02:20
v1.5.0
Demonstration
Pression (cmH2O)
Gel
60
30
0
0
6
12
18
Débit (L/min)
t(s)
160
0
-160
fCT
c/min
120
90
101
no CT
min
0:33
EtCO2
mmHg
49
30
--
P-P
cmH2O
22.2
FiO2
%
26
18
21
VMe
L/min
25.0
3.0
23.9
1/2
Seuils auto.
Réarmer
Historique
Retour
FiO2
%
100%
f CPV
c/min
10
PB sync
cmH2O
5
PH sync
cmH2O
15
T haut
s
1.0
CPV
Masque
ADULTE

CARDIO PULMONARY VENTILATION

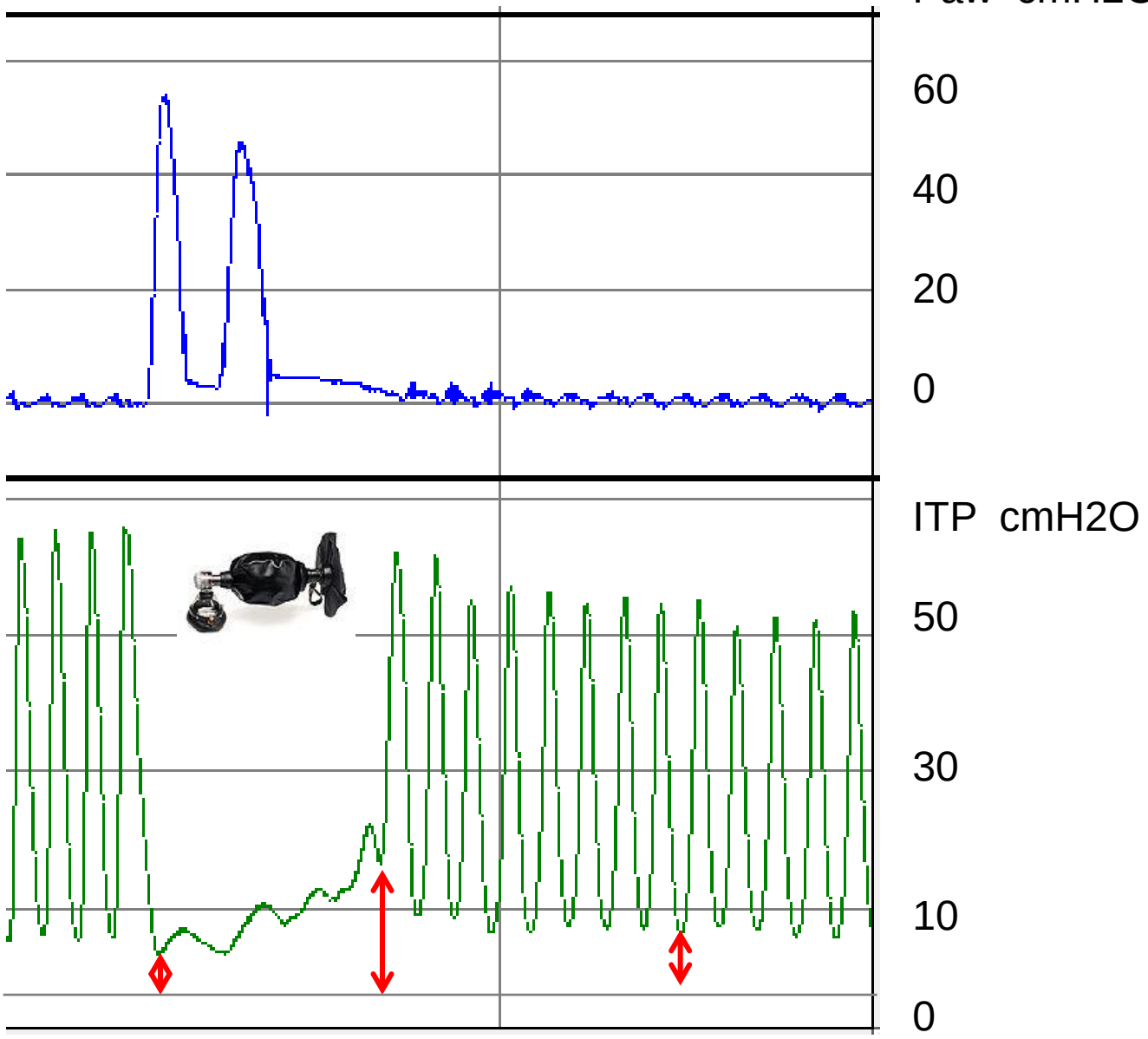
CAVIAR
Cardiac Arrest and Ventilation
International Association for Research

Protocole THIEL



CAVIAR
Cardiac Arrest and Ventilation
International Association for Research

tests in Thiel human cadavers

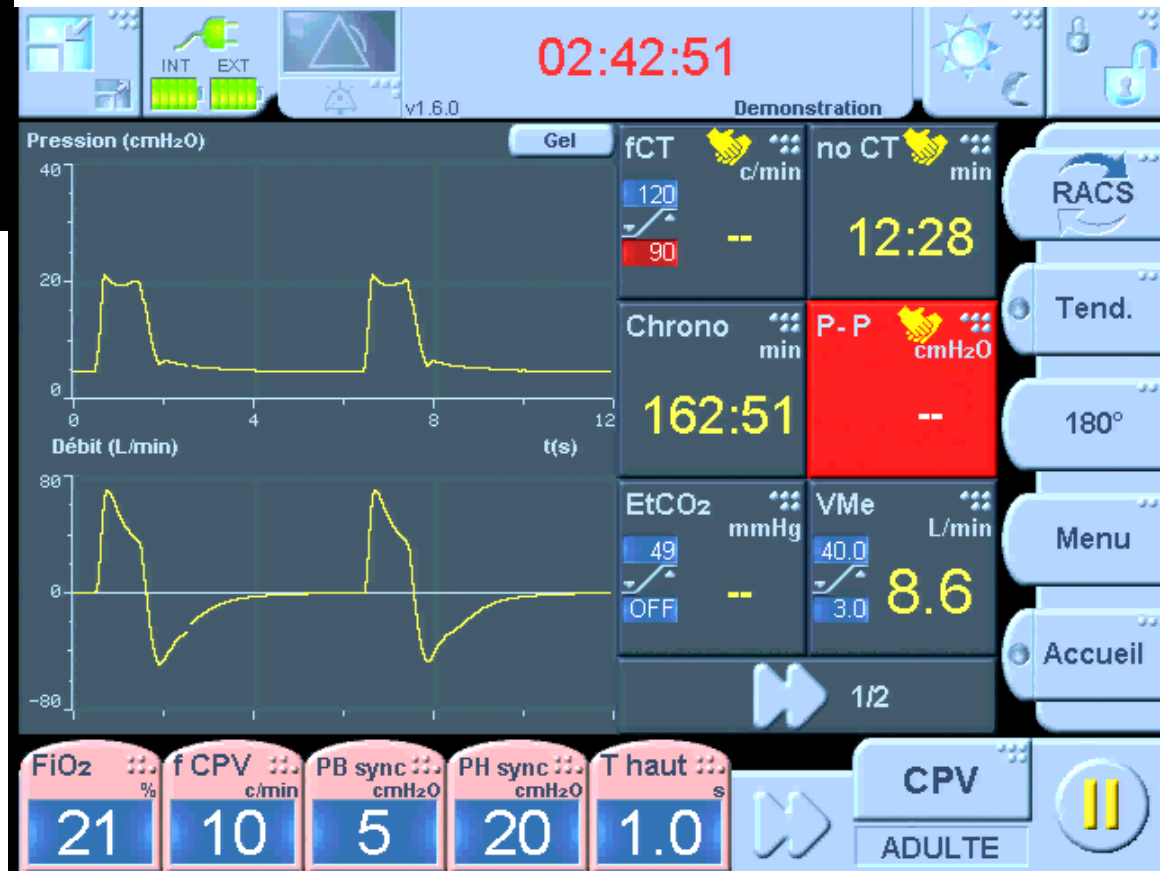


30:2 CPR performed by 2 rescuers

CPV + CT automatisées

[redacted]

CAVIAR
Cardiac Arrest and Ventilation
International Association for Research

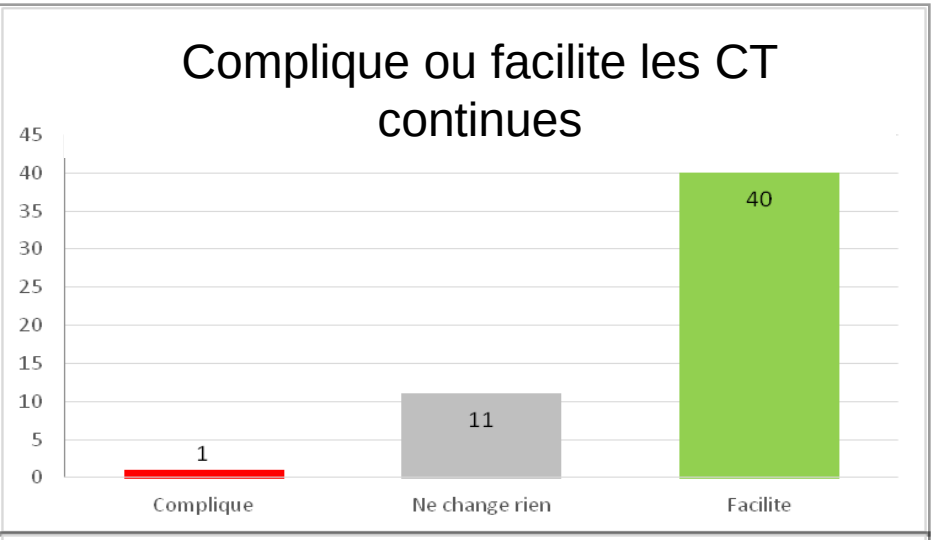


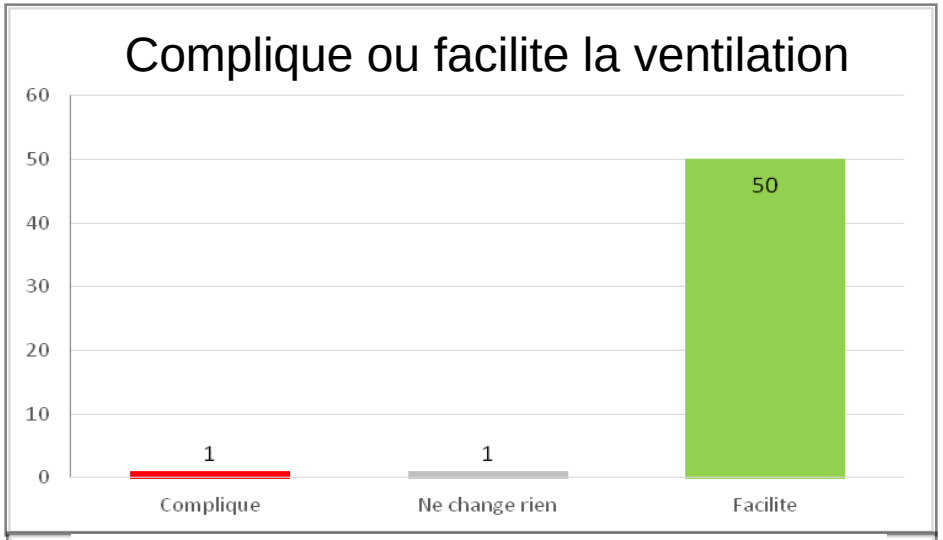
IN VITRO EVALUATION

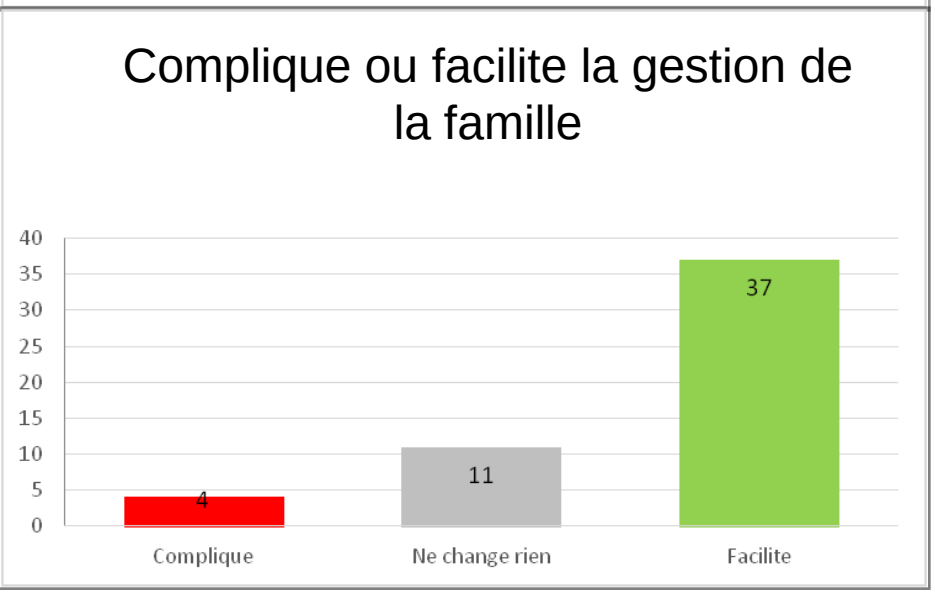
Scenario on mannequins

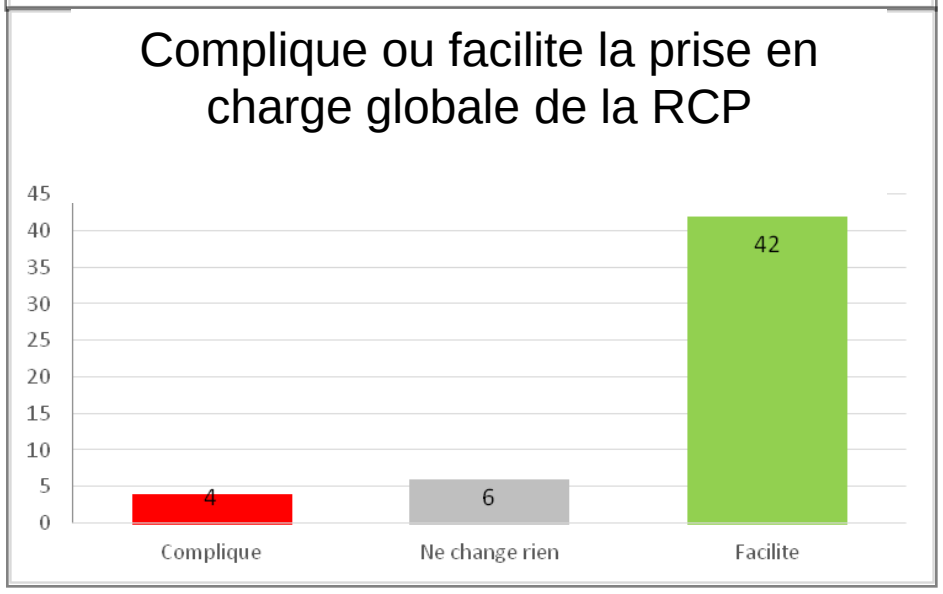
- More than 10h of CPV ventilation during CPR
- Evaluation from 100 rescuers (4 scenari)
- Intra hospital and out hospital scenario

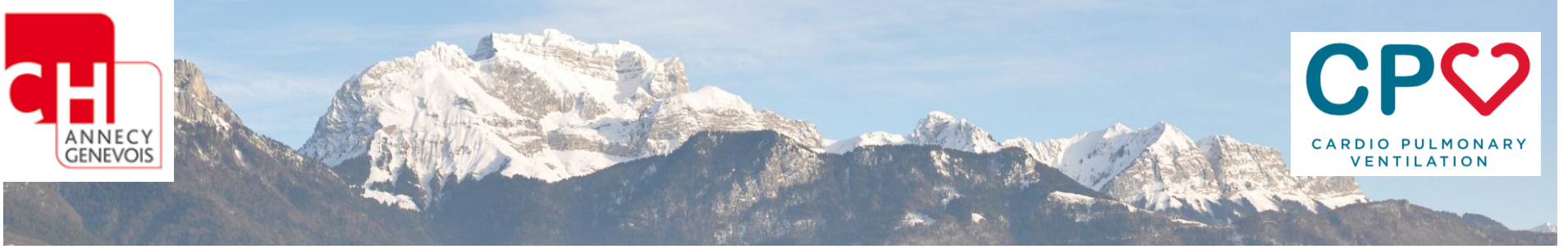
Résultats (2) enquête « ressenti »







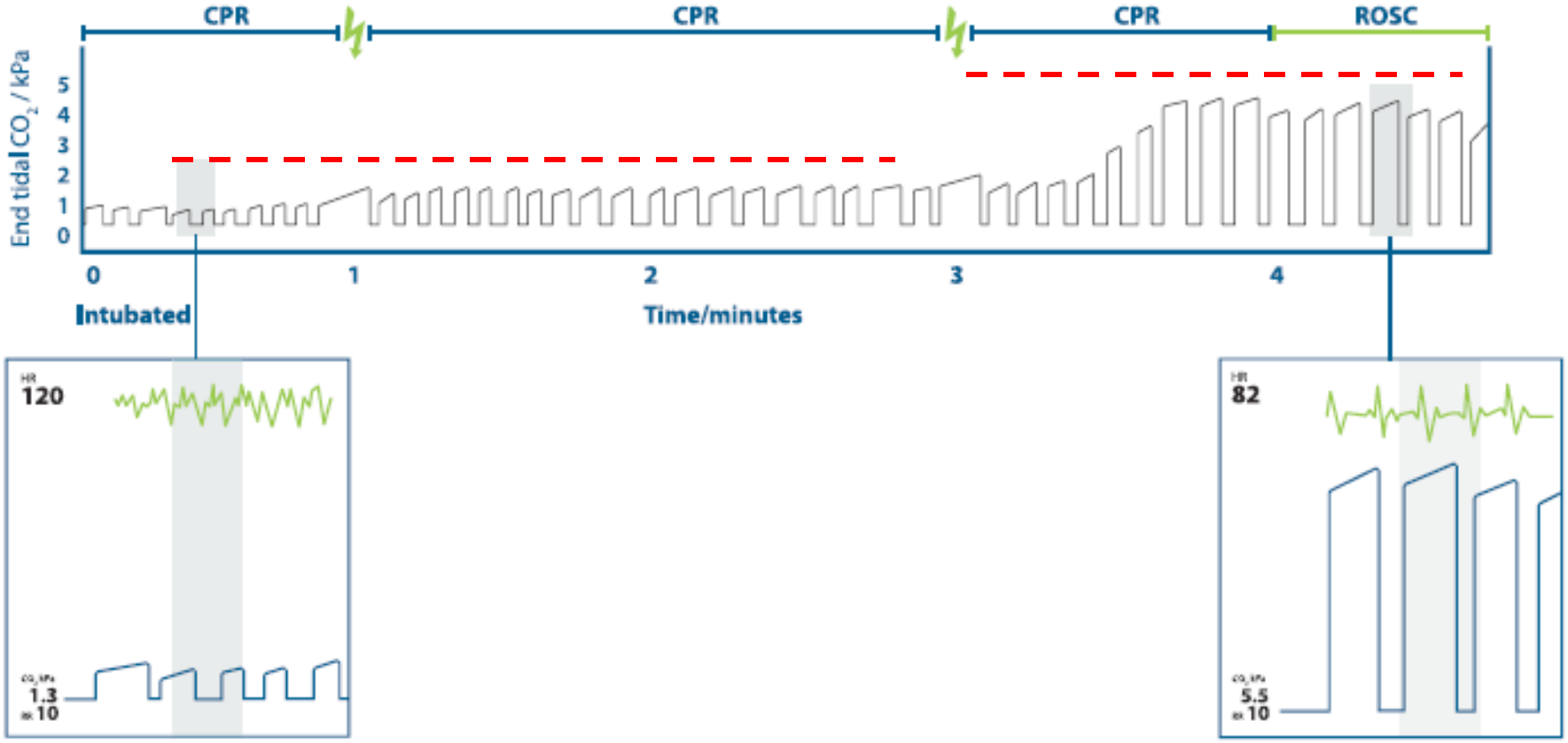




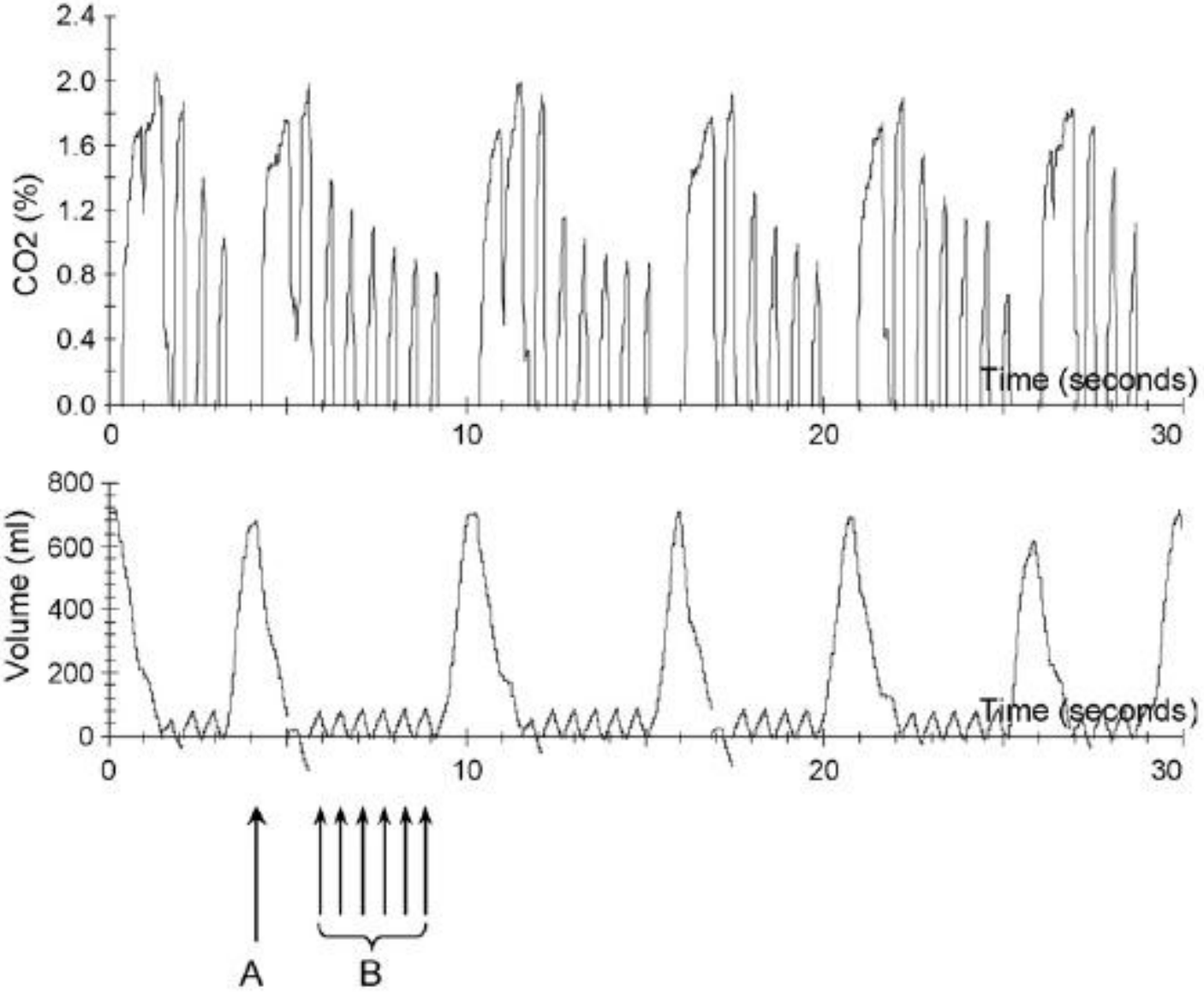
A quoi sert le signal d'EtCO2 pendant la RCP ?

25 March 2016

ERC Guidelines 2015 on $EtCO_2$ monitoring

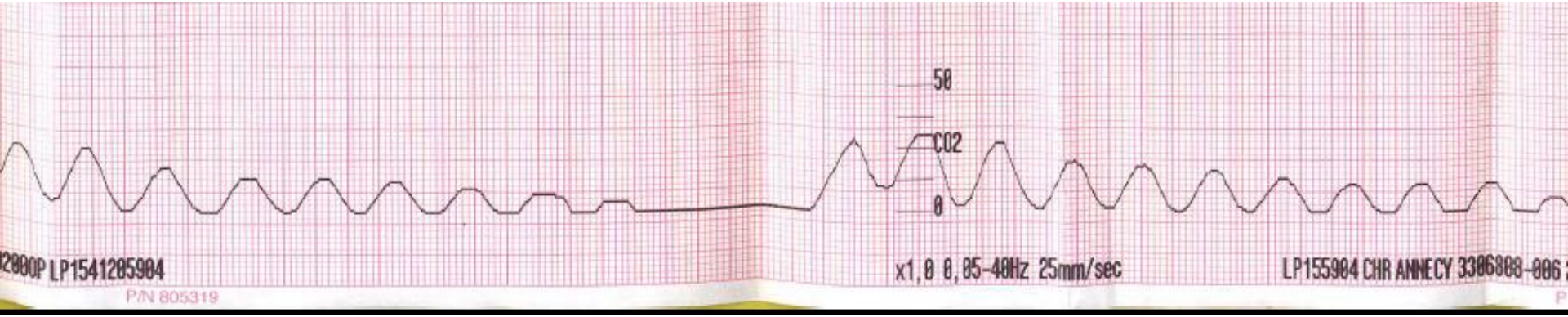


"Our Lack of confidence in the accuracy of $EtCO_2$ measurement during CPR, and the need of advance airway to measure EtCO2 reliably, limits our confidence in its use for prognostication" ….


2.4
2.0
1.6
1.2
0.8
0.4
0.0
CO2 (%)
Time (seconds)
0
10
20
30
800
600
400
200
0
Volume (ml)
Time (seconds)
0
10
20
30
A
B

EtCO2 observed during prolonged CPR

CPV
CARDIO PULMONARY VENTILATION

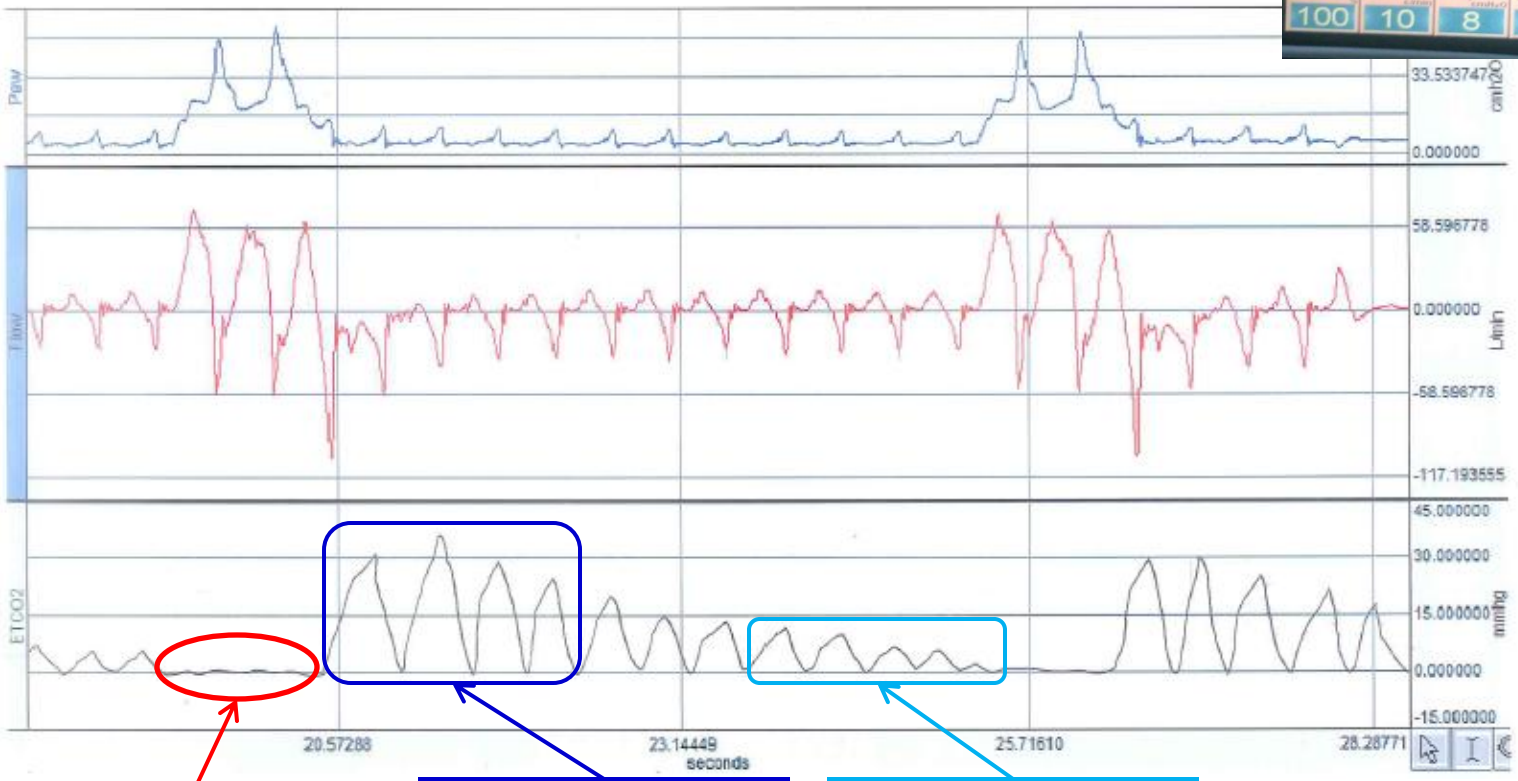

50
CO2
0
x1,0 0,05-40Hz 25mm/sec
LP155984 CHR ANNECY 3386808-006
P/N 805319


100
CO2
0

EtCO2 observed during prolonged CPR

CPV
CARDIO PULMONARY VENTILATION

$EtCO_2$ monitoring during prolonged CPR : Physiological Interpretation



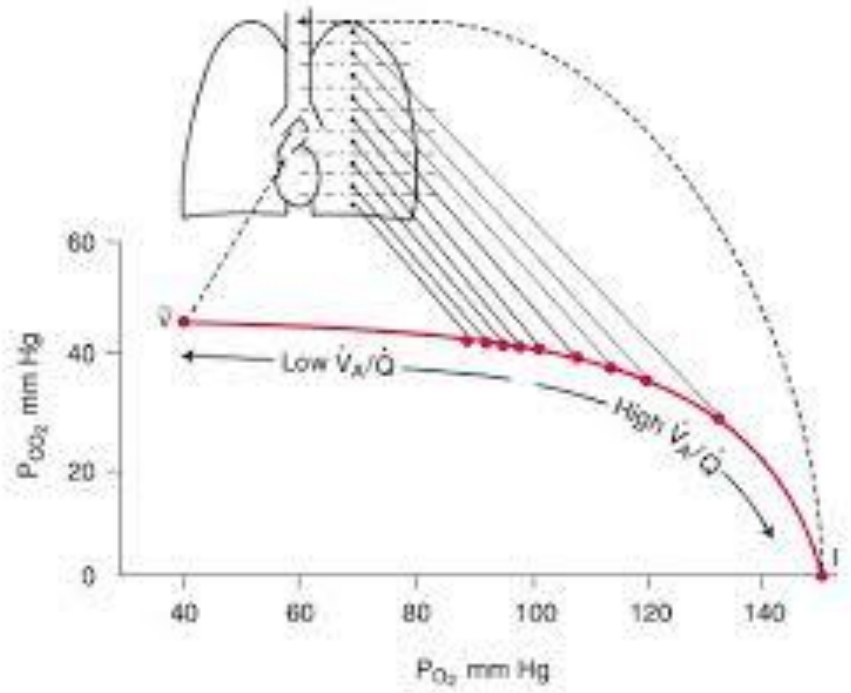
Insufflation from the ventilator

Alveolar CO2 Removal

Dead space ventilation

EtCO2 during CPR : pitfalls and questions

EtCO2 depends on :
Ventilation and Circulation



CONCLUSIONS

Revisiter la ventilation pendant la RCP pour:

- Eviter les effets délétères de la ventilation au BAVU
- Favoriser « CT et ventilation continues) pour obtenir un pourcentage de CT continu >80%
- Pressuriser et oxygéner pour maintenir les volumes pulmonaires
- Ne pas nuire à la circulation voir l'optimiser
- Améliorer le monitorage de l'EtCO2

Trial of Continuous or Interrupted Chest Compressions during CPR

Table 2. Post-Treatment Characteristics and Treatments Received by Patients in the Effectiveness Population.*

Characteristic	Intervention Group (N = 12,653)	Control Group (N = 11,058)	P Value
Chest-compression fraction‡	0.83±0.14	0.77±0.14	<0.001
Median	0.90	0.82	
Interquartile range	0.82–0.96	0.74–0.89	

CONCLUSIONS

In patients with out-of-hospital cardiac arrest, continuous chest compressions during CPR performed by EMS providers did not result in significantly higher rates of survival or favorable neurologic function than did interrupted chest compressions.