



Modes ventilatoires du nouveau-né : mieux comprendre pour mieux utiliser

Pr Florent Baudin, PU-PH

Anesthésie et réanimation pédiatrique

Hôpital Femme Mère Enfant – Hospices Civils de Lyon

Florent.baudin@chu-lyon.fr



Déclaration d'intérêts

- ADENE
- SEDANA MEDICAL
- DRAGER
- LOWENSTEIN
- TIMPEL
- FISHER & PAYKEL



Non invasif

Haut débit nasal

Ventilation non invasive



ventilation conventionnelle

Mode alternatif

Oscillation haute fréquence

Invasif



Non invasif

Haut débit nasal

Ventilation non invasive



ventilation conventionnelle

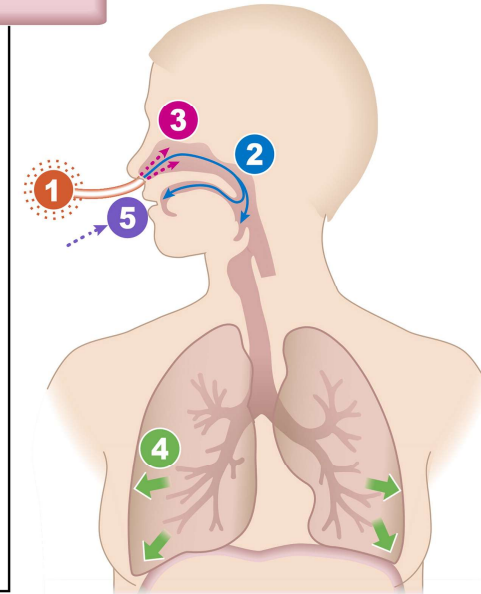
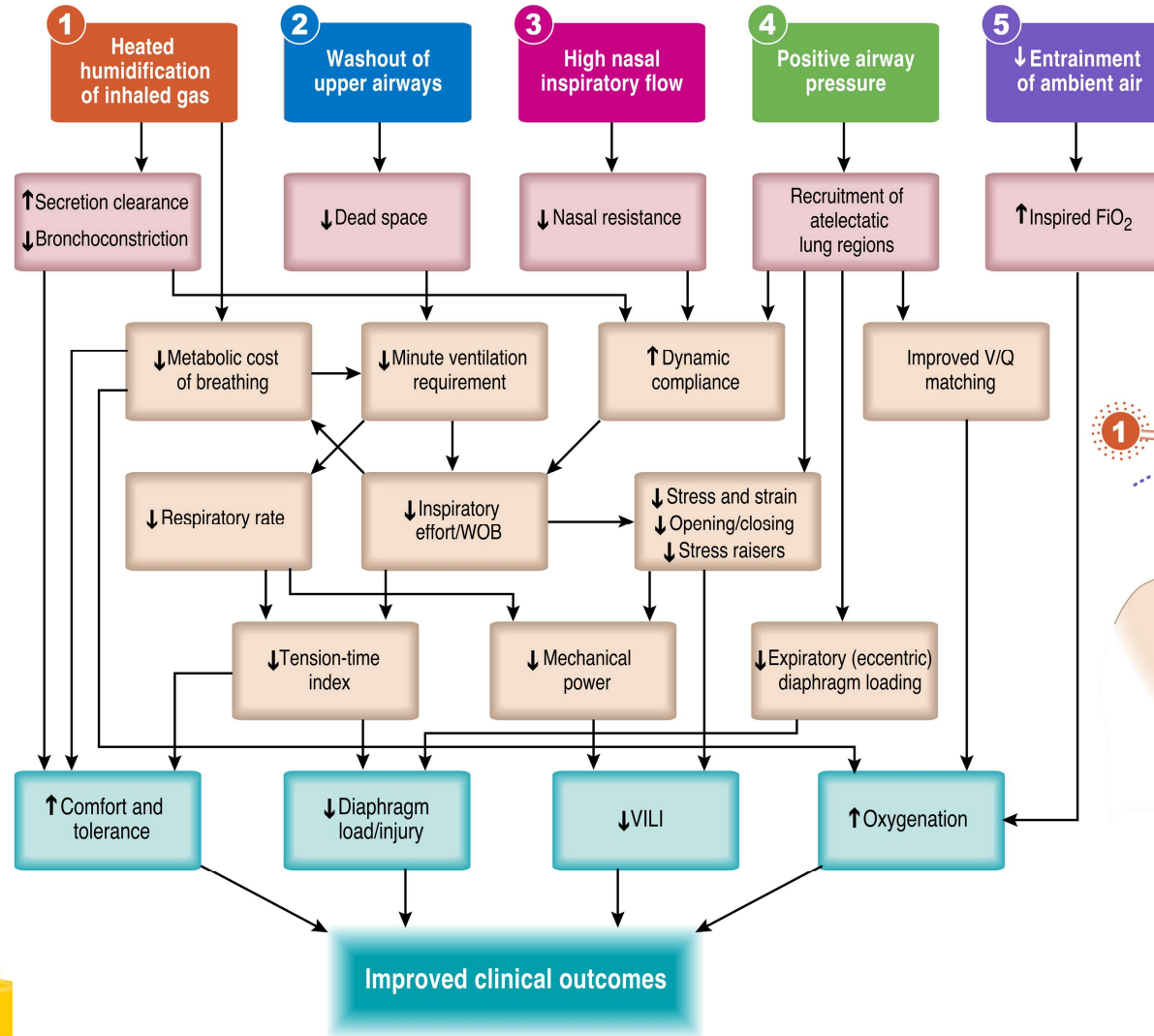
Mode alternatif

Oscillation haute fréquence

Invasif



Haut Débit Nasal





Haut Débit Nasal

Débit :

Nourrisson: 2L/kg/min

Prématuré : 2 à 4 L/Kg/min



Cochrane Database of Systematic Reviews

[Intervention Review]

High flow nasal cannula for respiratory support in term infants



Cochrane Database of Systematic Reviews

[Intervention Review]

Nasal high flow therapy for primary respiratory support in preterm infants

Kate A Hodgson^{1,2}, Dominic Wilkinson^{3,4}, Antonio G De Paoli⁵, Brett J Manley^{1,2}

Résultats

HFNC > Oxygénothérapie (échec)

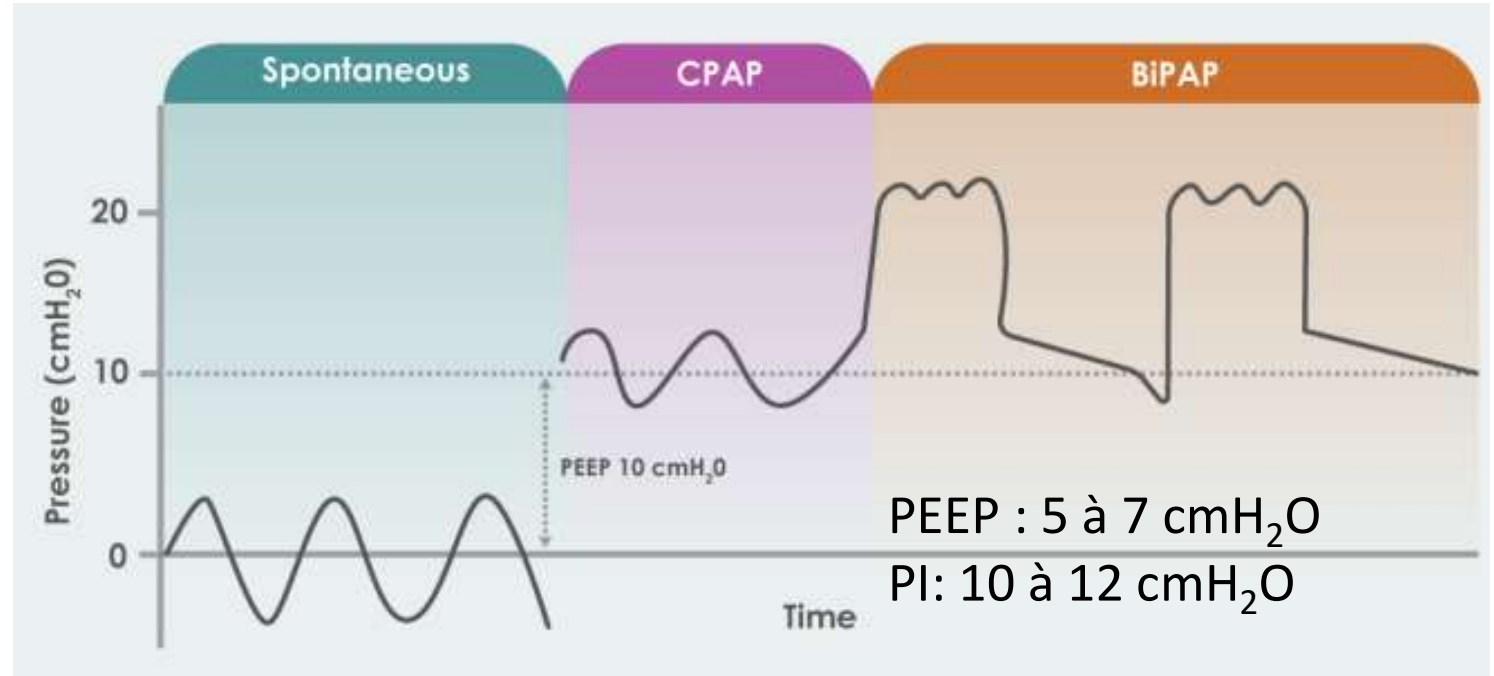
HFNC = CPAP (mortalité , DBP)

HFNC > CPAP lésion cutanée nasale, pneumothorax

Li Jet al. The effects of flow settings during high-flow nasal cannula oxygen therapy for neonates and young children. Eur Respir Rev 2024; 33: 230223



Ventilation Non-invasive



BIPAP: Bilevel Positive Airway Pressure

NIPPV : Non Invasive Positive Pressure Ventilation

S

A



Non invasif

Haut débit nasal

Ventilation non invasive



ventilation conventionnelle

Mode alternatif

Oscillation haute fréquence

Invasif



TAXONOMIE ?

Pourquoi c'est important ?

BIPAP SIMV PC-CMV PC-CMV NAVA EASYVENT MMV
PPSV PRVC PRFC PSV BiLevel NAVA ASV MMV
TGI APRV PC-PSV BiPA EASYVENT PAV+
MIPV MIPV VS-PEP PEEP BiLevel VAF CPAP CCV
VS-PEP SIMV PDI VAIE VAPS Pressure Control AC+ Automode
MVV VC-AT DUOPAP SPONT DUOPAP HFT MPV
Oliv PS-IMV PEP VAF SiPPV VS-AI VV+
PRICO No-Disconnexion HFOV HFOV APNOEAVIE VC-AI
MIPV MPV ACV ACV+ VC+APV PPS BiVent PPS
HFT PS-IMV VV+ AVM ACV AC-PV MV+
MPV MPV VS-AI MPP AVM PEP SUPPORT INTELLiVENT
MPV VS-DIVC HFT MPV VENTILATOIRE APRV



TAXONOMIE: principe

1

Variable contrôlée

Pression
Volume

2

Cycles respiratoires

CMV continuous mandatory
IMV intermitent mandatory
CSV continuous spontaneous

3

Réglage / Cible

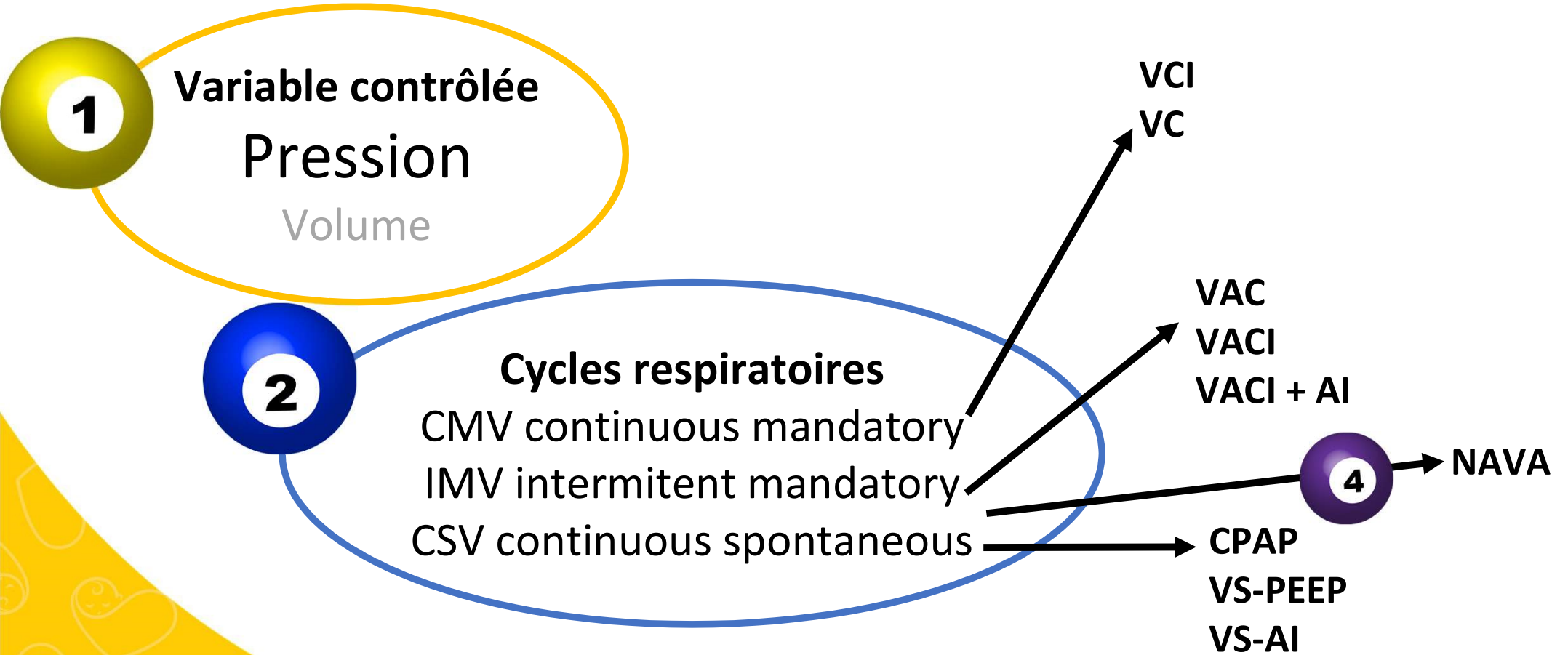
Set point, dual,
servo, adaptative, ...

4

Trigger



Les modes conventionnels en néonate



V comme ventilation !!!!!!!



Focus: volume garanti

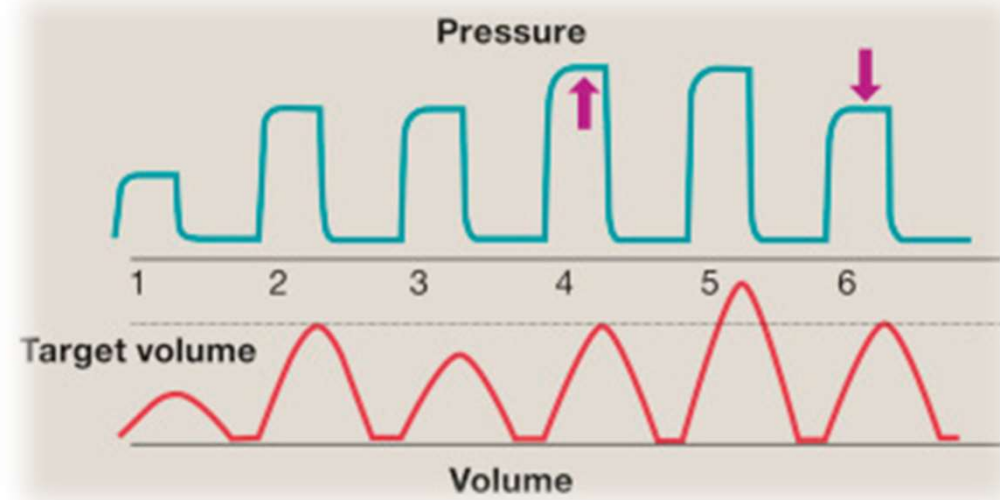
La limite des modes en pressions :

$$P_{aw} = P_0 + P_{raw}(t) + P_{el}(t)$$



Volume x 1/compliance

= PRESSION à volume cible !!

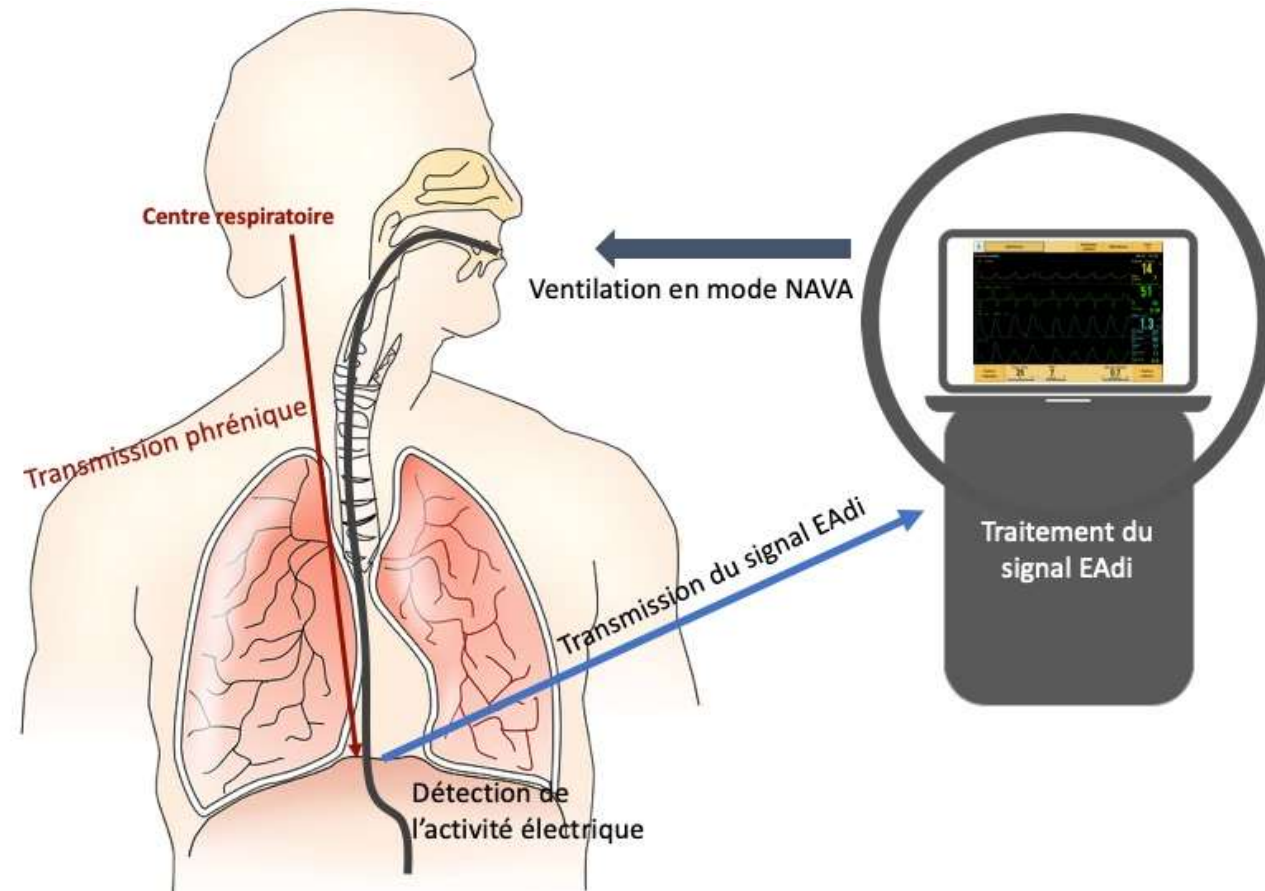
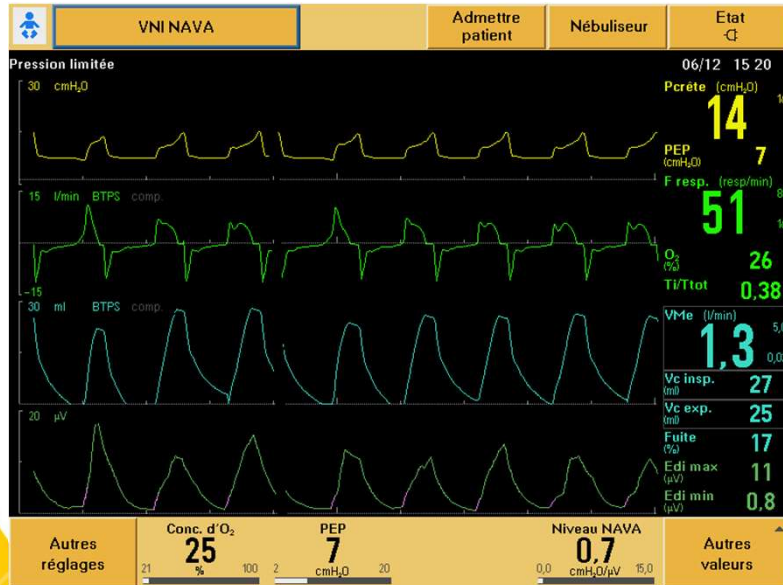


Practice points:

- Volume targeted ventilation is the standard method of ventilating preterm babies
- There are a number of volume targeted ventilation modes including the hybrid modes such as volume guarantee, Pressure regulated volume control and volume control ventilation.
- There are no differences in short term outcomes to discharge between volume control and volume guarantee ventilation



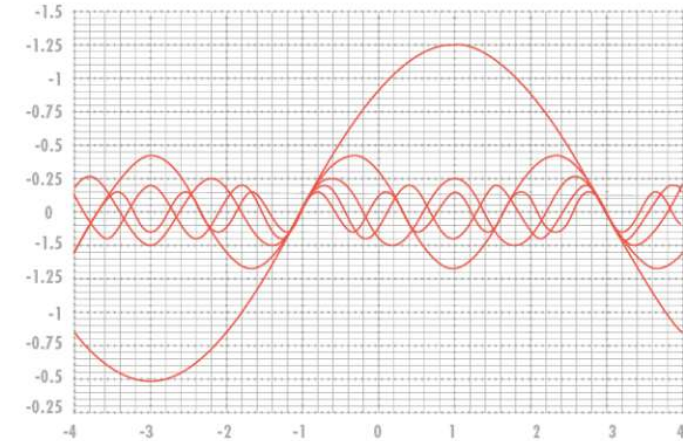
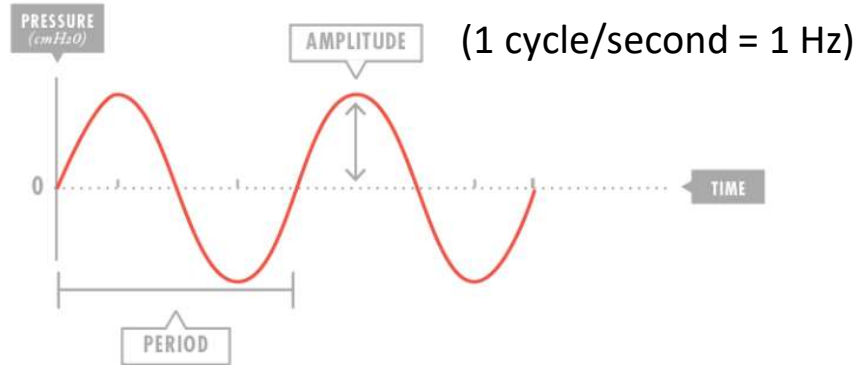
Focus : NAVA



Synchronisation et ventilation proportionnelle



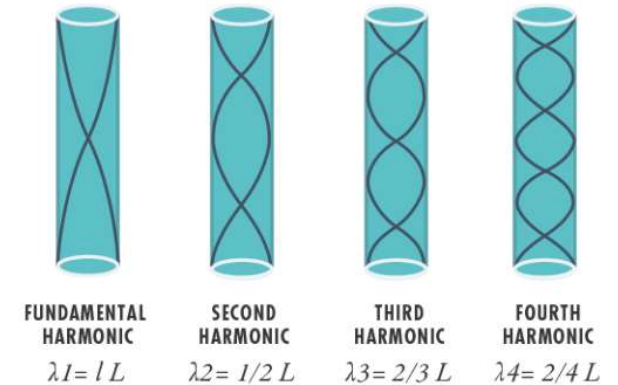
OHF : Oscillation à haute fréquence



Pont de Broughton

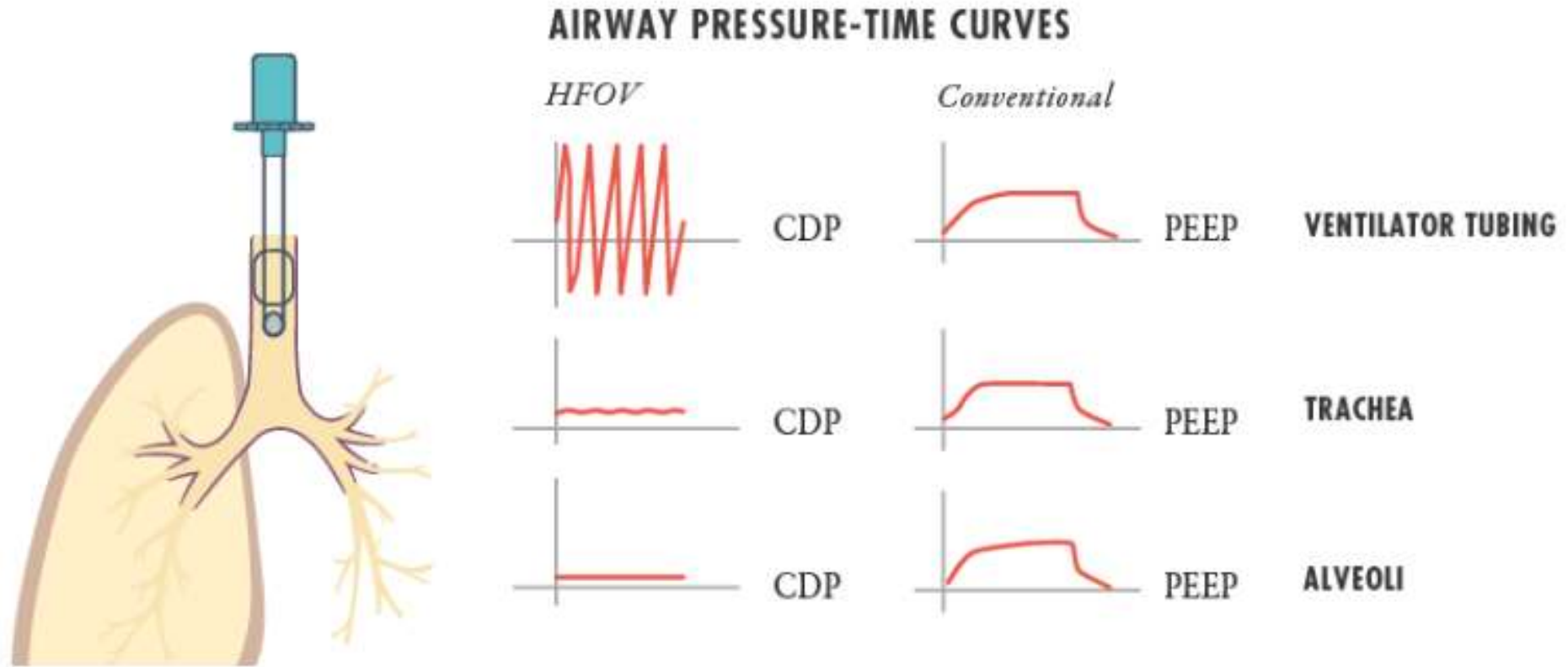
La résonance est le fait qu'un système se mette à osciller lorsqu'il est soumis à des impulsions régulières à une fréquence donnée

Les harmoniques: oscillations secondaires





OHF : Oscillation à haute fréquence

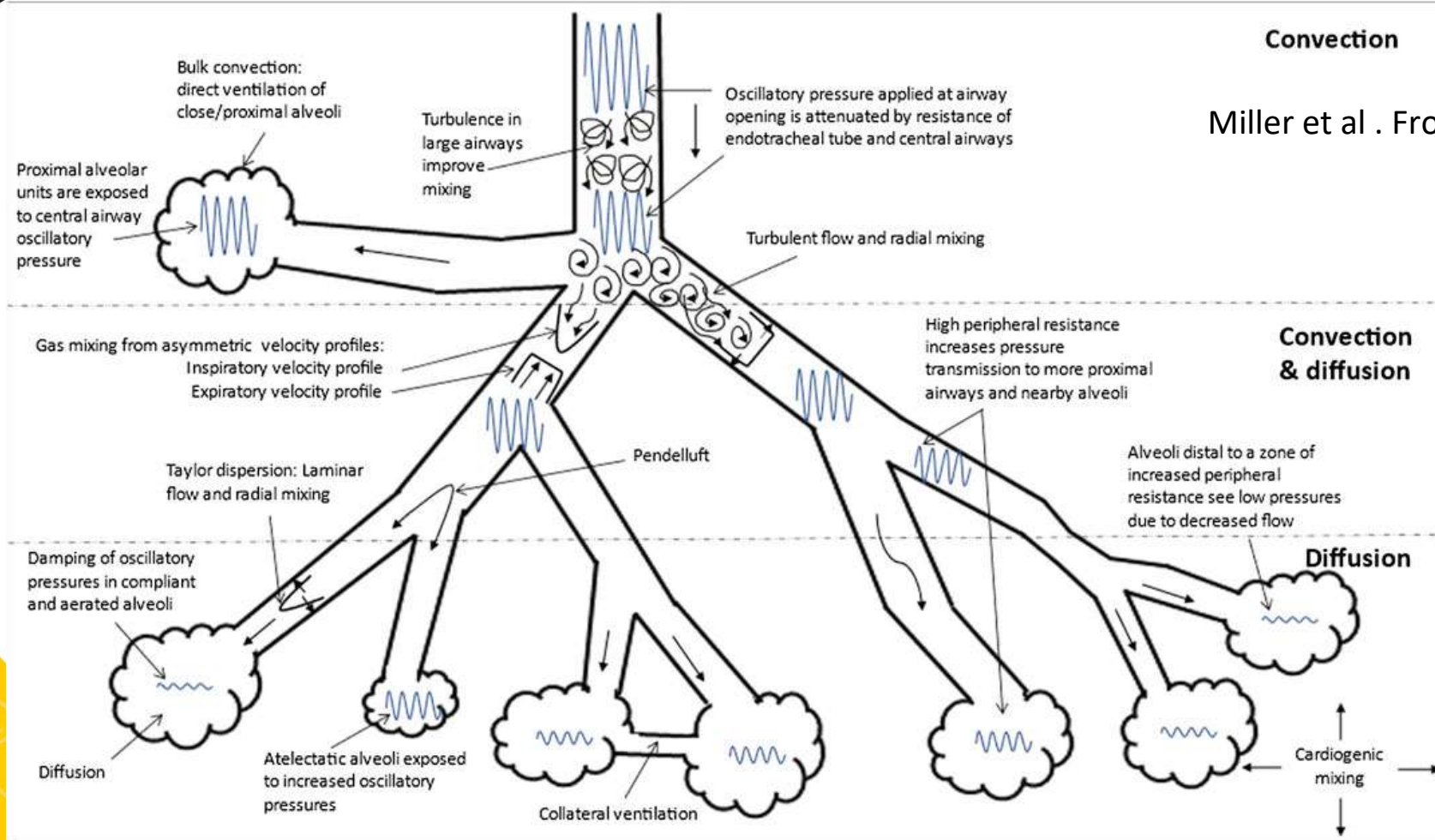


L'OHF pour un anesthésiste réanimateur...



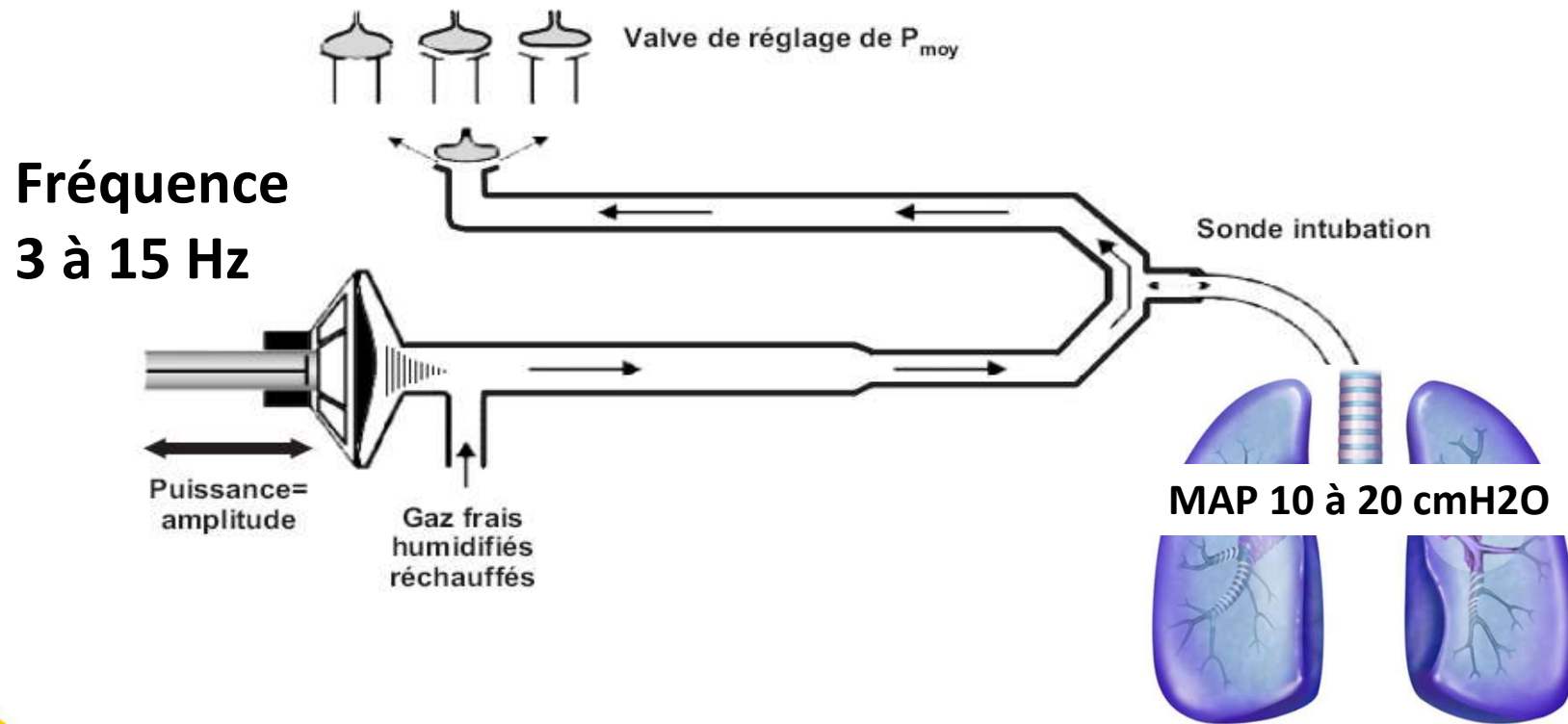
OHF : Oscillation à haute fréquence

Convection
Miller et al . Front. Physiol 2022





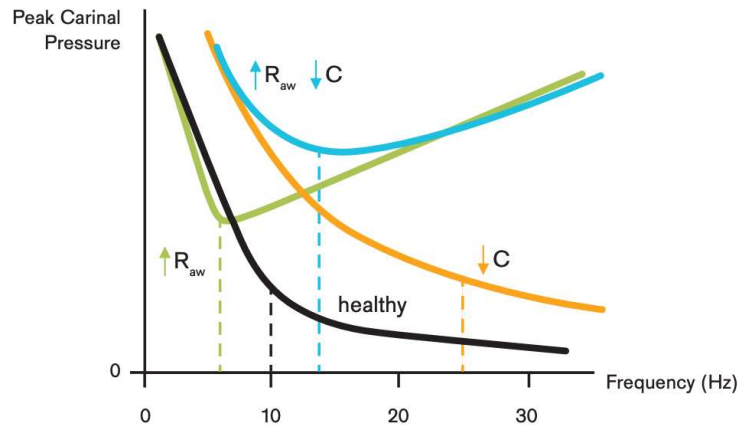
OHF : Oscillation à haute fréquence





OHF : Réglages initiaux

La fréquence



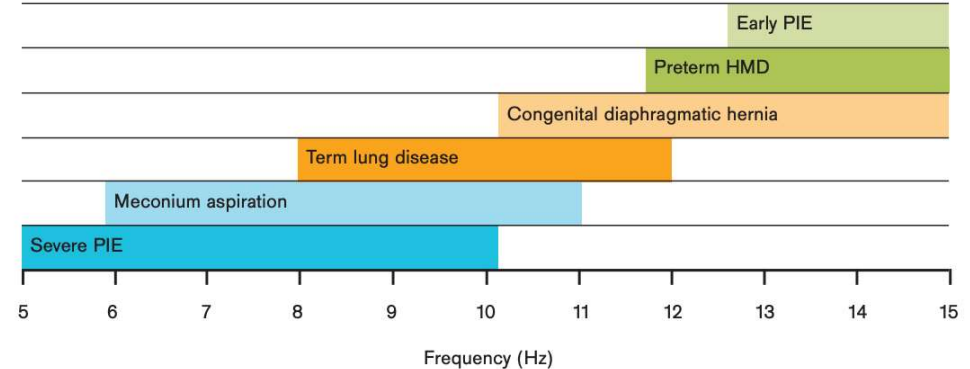
D-8080-2016

Figure 6-5: Effect of mechanical properties on the peak pressures transmitted to the carina. Adapted from (15). Corner frequency is shown by the dashed lines, representing the point at which most gain in minimising carinal peak pressures are achieved. Low compliance (C) shifts the optimal frequency to the right, whereas lower frequencies are more optimal for settings in which airway resistance (R_{aw}) is increased.

PRACTICAL TIPS

T

HFOV FREQUENCY



D-8068-2016

Figure 12-1: Suggested HFOV frequency ranges for common neonatal conditions.

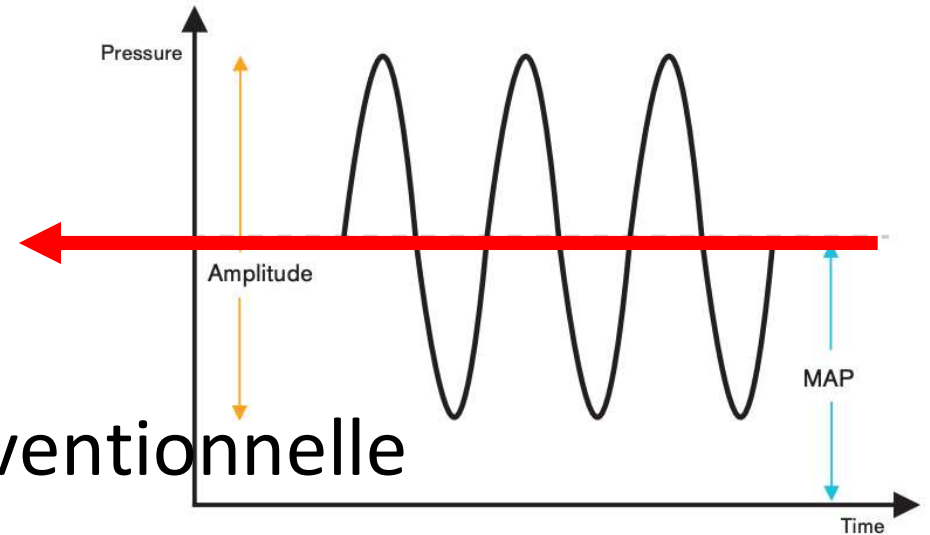
Encore pour un anesthésiste réanimateur...
version simplifiée



OHF : Réglages initiaux

La MAP

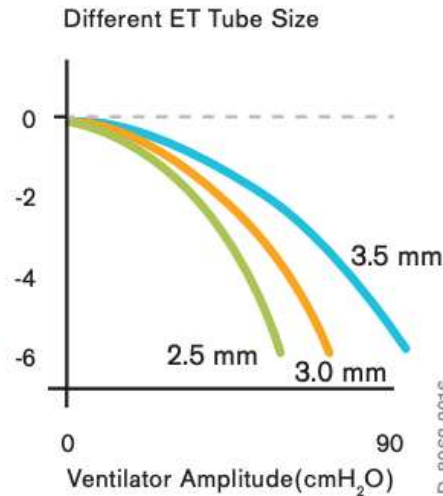
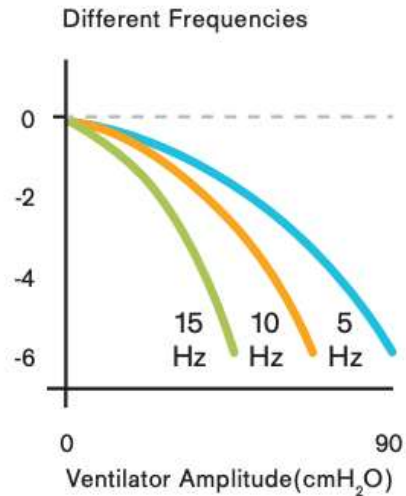
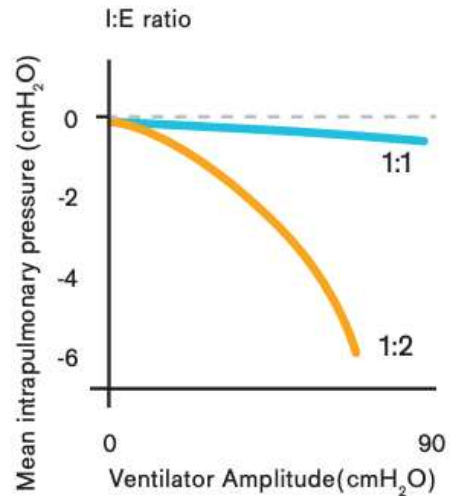
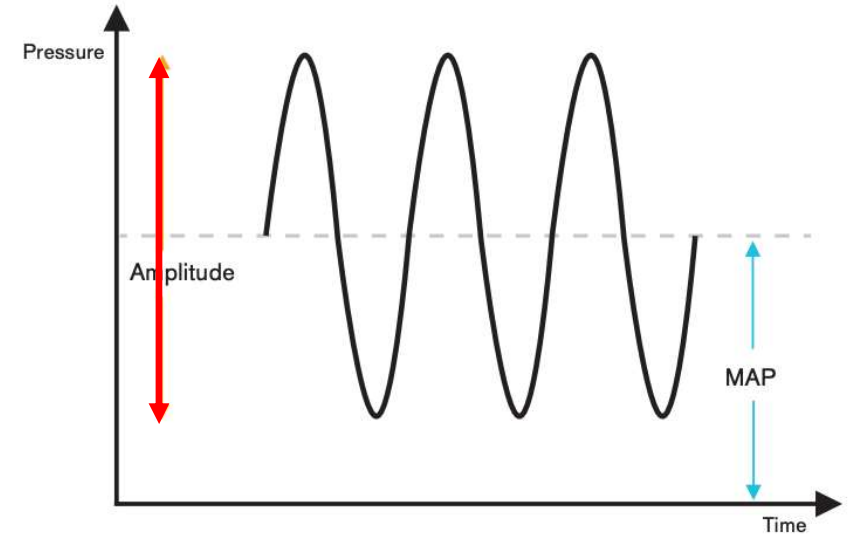
- 2 à 4 cmH₂O
au dessus de la MAP conventionnelle
- 8 à 10 cmH₂O
puis augmenter de 1 à 2 cmH₂O/5 à 10 min



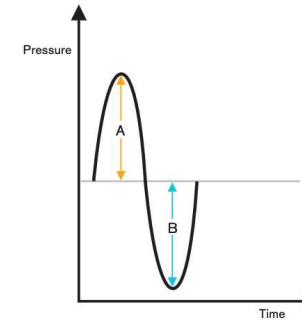


OHF : Réglages initiaux

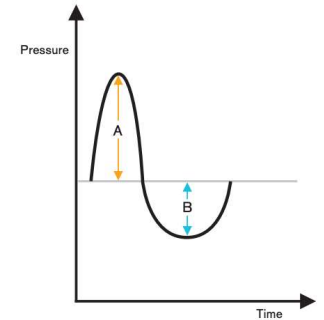
L'amplitude
40 à 50 cmH₂O ou %



D-8062-2016



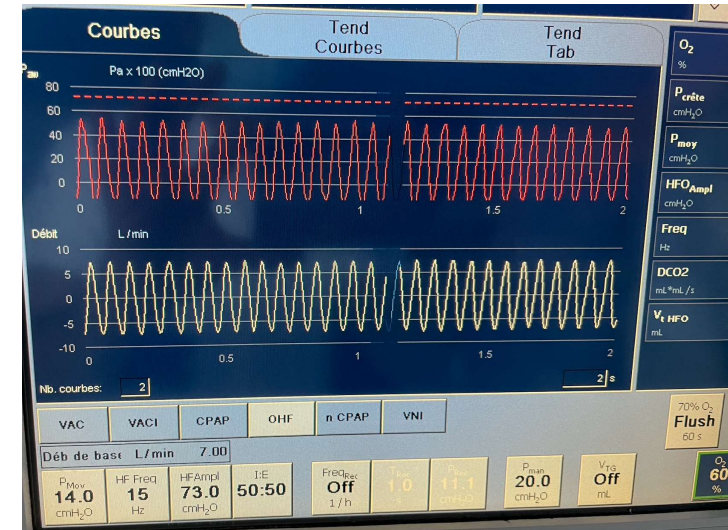
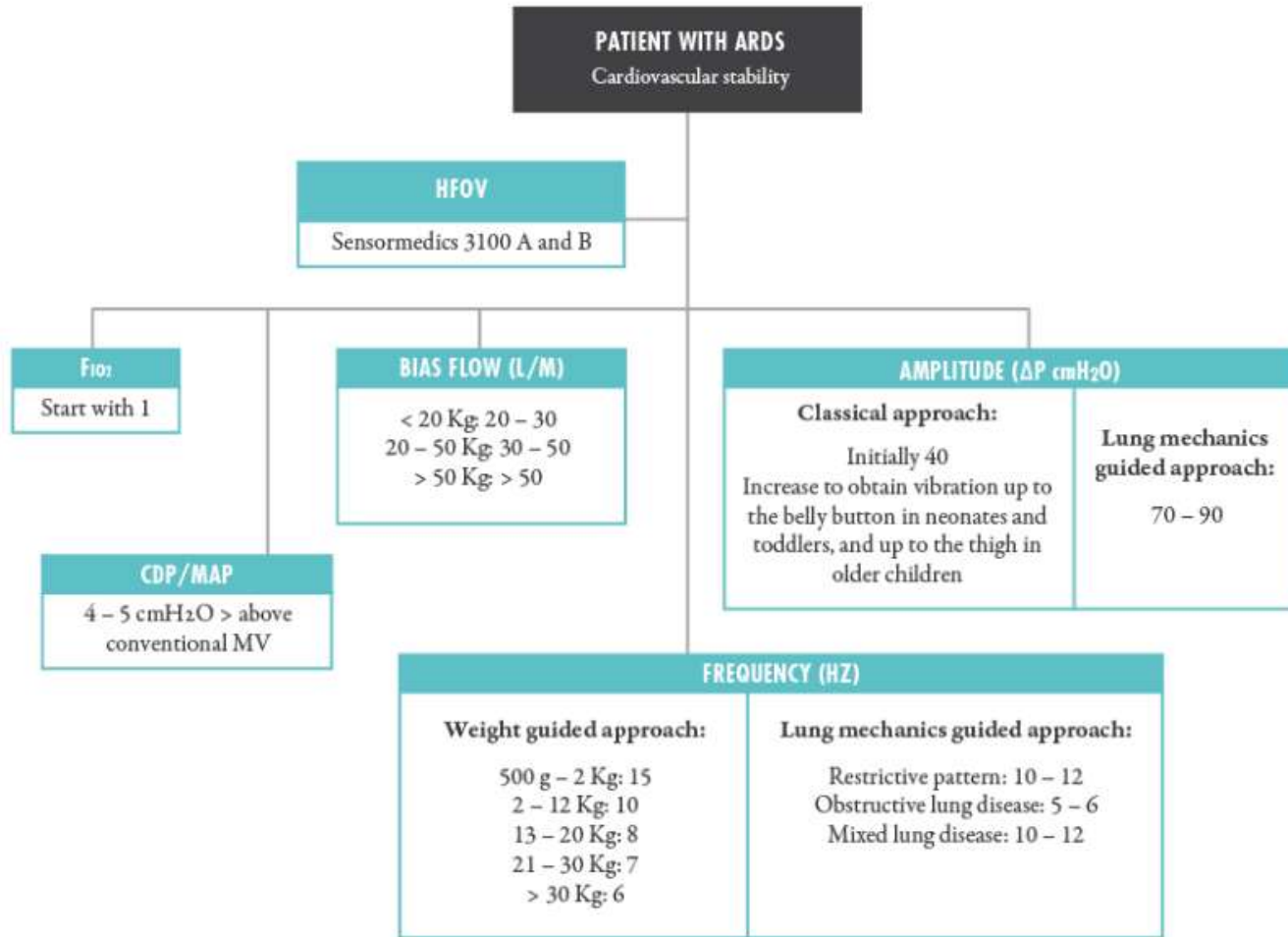
I:E = 1:1
A = B



I:E = 1:2
A ≠ B



OHF : en pratique





Algorithme

| Previous situation | S _p O ₂ | Classical approach | Lung mechanics guided approach (*) | |
|--|-----------------------------------|--------------------|--|---|
| High P _a CO ₂ | F _{IO₂} ≤ 0.5 | < 88% | ↑ amplitude and F _{IO₂} | ↓ frequency |
| | | < 88 – 95% | ↑ amplitude | ↓ frequency |
| | | > 95% | ↑ amplitude and adjust MAP | ↓ MAP, sign of overdistension |
| | F _{IO₂} > 0.5 | < 88% | ↑ amplitude and MAP | ↓ frequency, increase MAP |
| | | 88 – 95% | ↑ amplitude and MAP | ↓ frequency, increase MAP |
| | | > 95% | ↑ amplitude and adjust F _{IO₂} | ↓ F _{IO₂} , decrease MAP |
| Normal P _a CO ₂ | F _{IO₂} ≤ 0.5 | < 88% | ↑ F _{IO₂} | No change in frequency, increase F _{IO₂} , increase MAP |
| | | 88 – 95% | Adjust MAP | No change in frequency, adjust MAP |
| | | > 95% | No changes | No change in frequency, decrease MAP |
| | F _{IO₂} > 0.5 | < 88% | ↑ MAP | No change in frequency, increase MAP |
| | | 88 – 95% | Consider ↑ MAP | No change in frequency, consider increase MAP |
| | | > 95% | Adjust F _{IO₂} | No change in frequency, adjust F _{IO₂} , consider decrease MAP |
| Low P _a CO ₂ | F _{IO₂} ≤ 0.5 | < 88% | ↓ amplitude and ↑ F _{IO₂} | ↑ Frequency (if frequency at 15 Hz, decrease amplitude), increase F _{IO₂} |
| | | 88 – 95% | ↓ amplitude | ↑ Frequency (if frequency at 15 Hz, decrease amplitude) |
| | | > 95% | ↓ amplitude and adjust MAP | ↑ Frequency (if frequency at 15 Hz, decrease amplitude), decrease MAP |
| | F _{IO₂} > 0.5 | < 88% | ↓ amplitude and ↑ MAP | ↑ Frequency (if frequency at 15 Hz, decrease amplitude), increase MAP |
| | | 88 – 95% | ↓ amplitude and ↑ MAP | ↑ Frequency (if frequency at 15 Hz, decrease amplitude), consider increase MAP |
| | | > 95% | ↓ amplitude and adjust F _{IO₂} | ↑ Frequency (if frequency at 15 Hz, decrease amplitude), adjust F _{IO₂} |

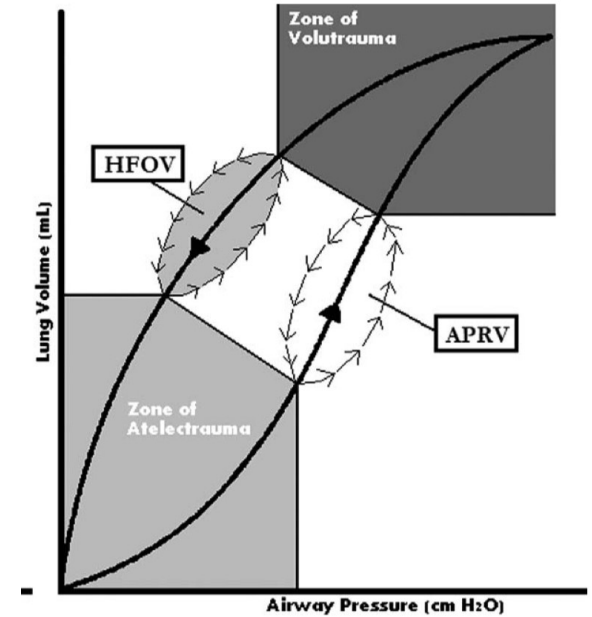
* Do not adjust amplitude to achieve a specific ΔP but use frequency to titrate ventilation



OHF : en pratique



Augmenter l'amplitude
Diminuer la fréquence
I/E proche de 1/1
Fuites autour de la sonde



FIO₂
Augmenter la MAP



CONCLUSION

néonatalogie [neonatɔlɔʒi] n. f. :

L'art de faire la même chose différemment



CONCLUSION

Physiologie néonatale spécifique

Contrainte techniques

V = Ventilation (*et non volume*)

Importance de la nomenclature

Modes alternatifs !

