

Excessive VTs During Spontaneous Unassisted or Assisted Breaths *Drugs to Suppress Drive? Often Times NO!*

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Disclaimers

- Consultant: Breathe Technology, Ventec

Objective

- Manage patients by balancing the benefits and the potential harm of spontaneous efforts in patients with respiratory failure

The Clinical Conundrum

- 49 yo man with traumatic brain injury from a motorcycle accident. Otherwise healthy.
- Likely aspirated at accident site prior to intubation. Patchy infiltrates on CXR.
 - GCS 6, no sedation, patient making vigorous inspiratory efforts
 - MV settings: PS 6 cm H₂O, PEEP 8 cm H₂O, FiO₂ 0.45, VT 710 ml (11 ml/kg IBW)
 - ABGs: pH 7.47, PCO₂ 34 mm Hg, PO₂ 78 mm Hg

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Are advantages of permitting spontaneous breathing worth the risk of VILI?????

Suppress Excessive Respiratory Drive?

- Why is this patient demanding higher VTs?
 - Metabolic issues (not apparent here)
 - Excessive vent support (not apparent here)
 - Irritated stretch receptors, impaired stretch reflexes (Herring Breuer)
 - Impaired vent control center from TBI and possibly SIRS
- Risks/benefits of high spontaneous VTs
- How do we manage this?
 - Fix the fixable
 - Then what?

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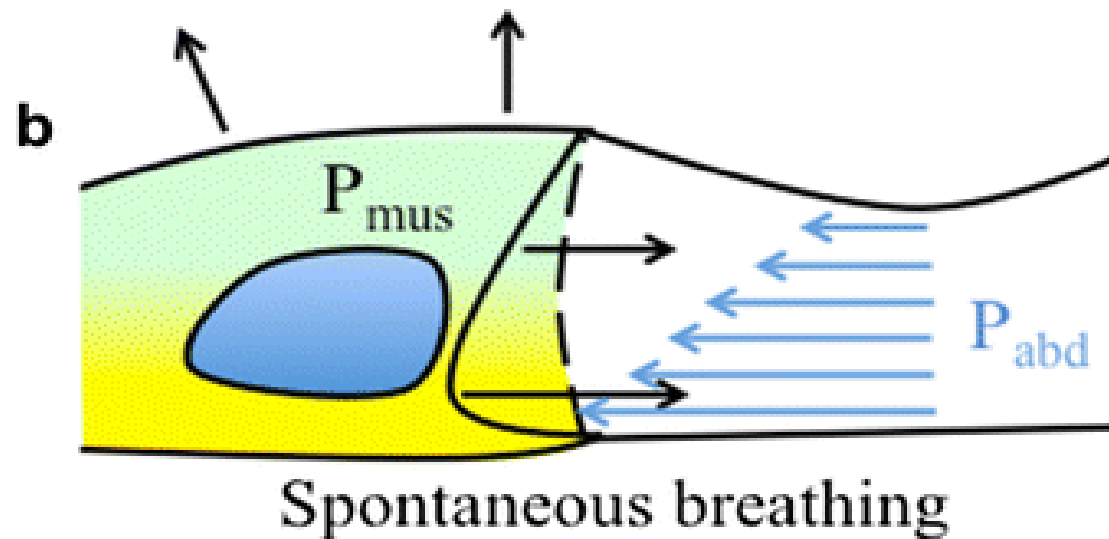
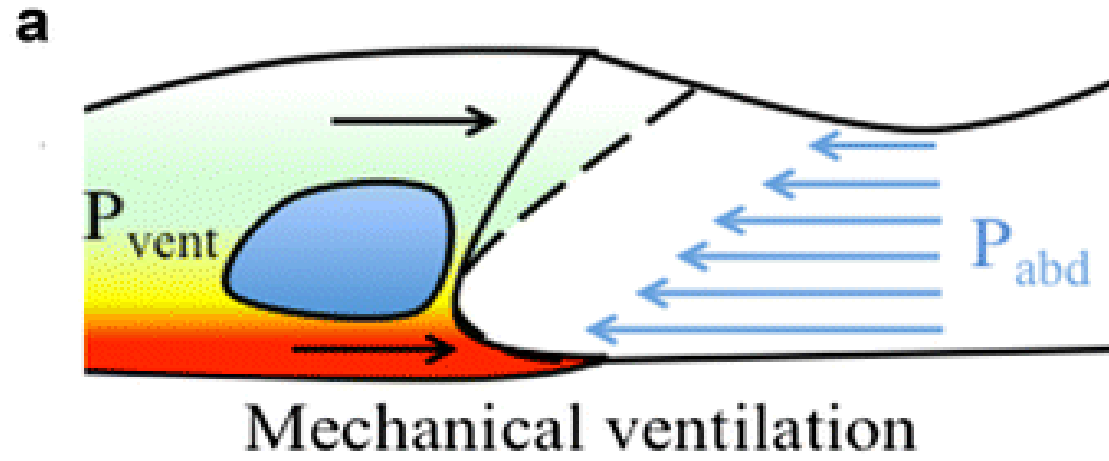
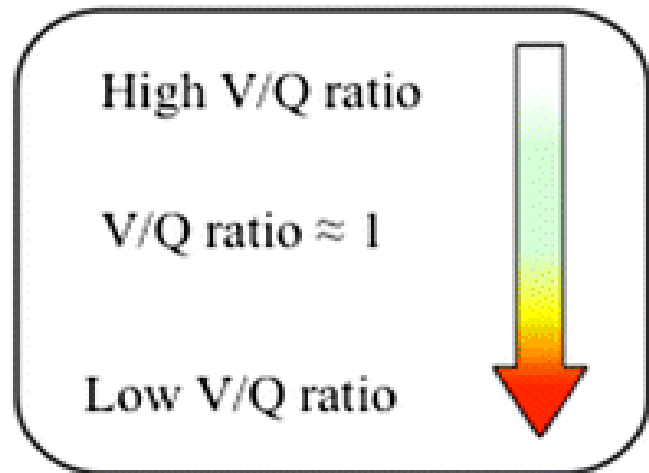
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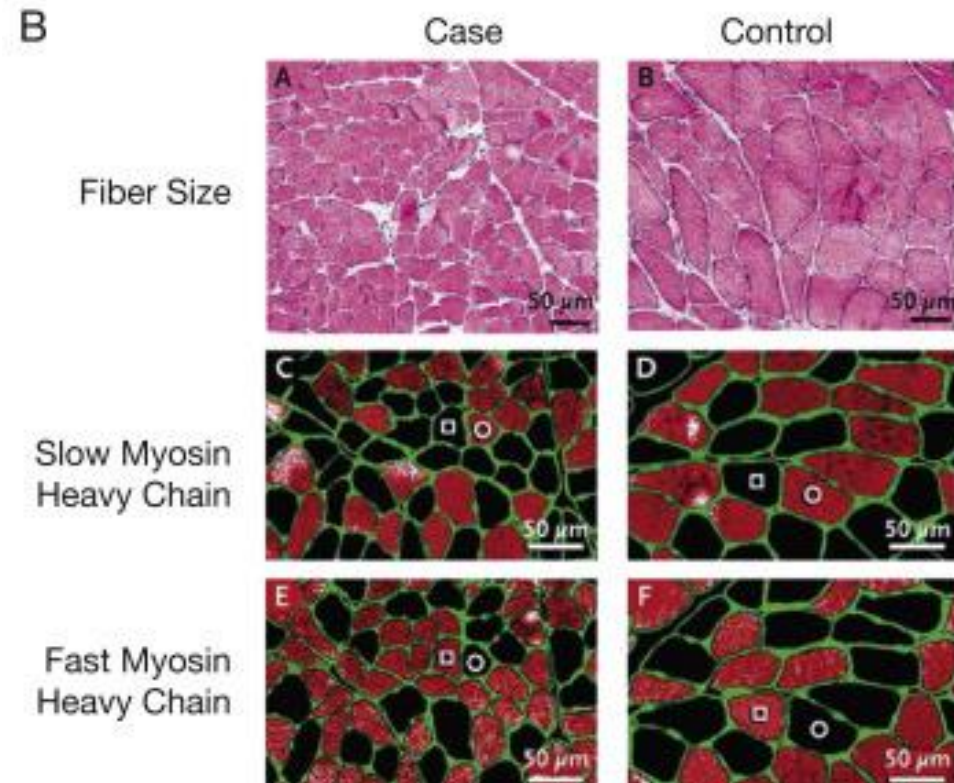
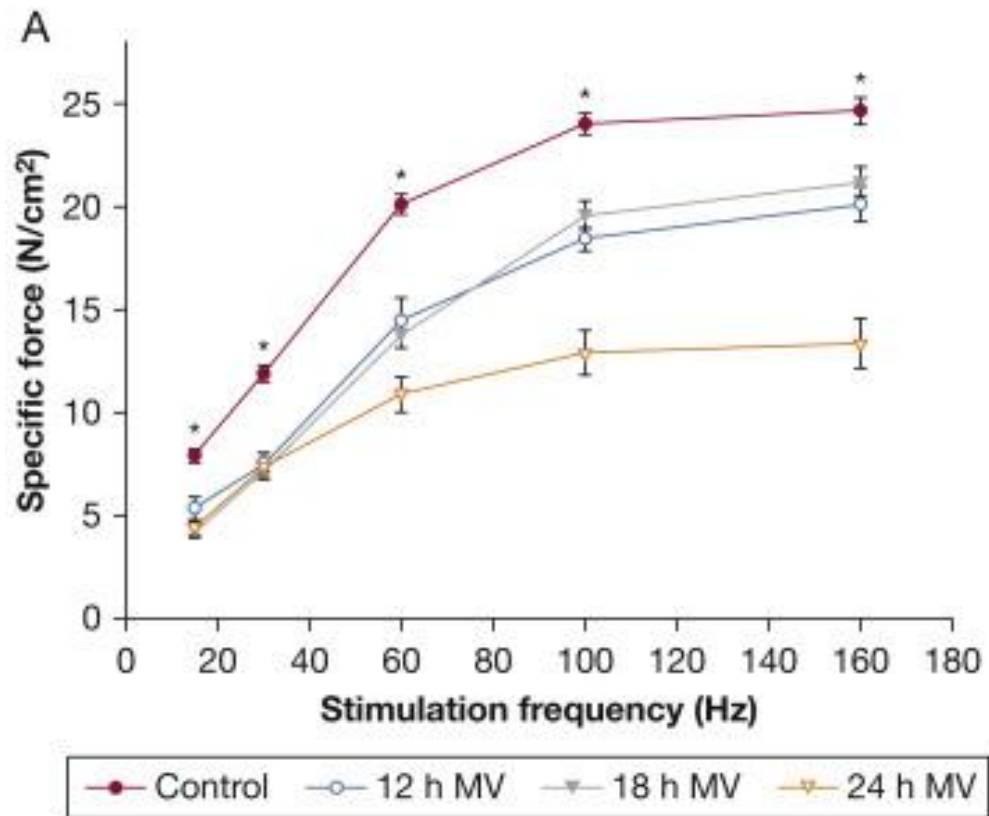
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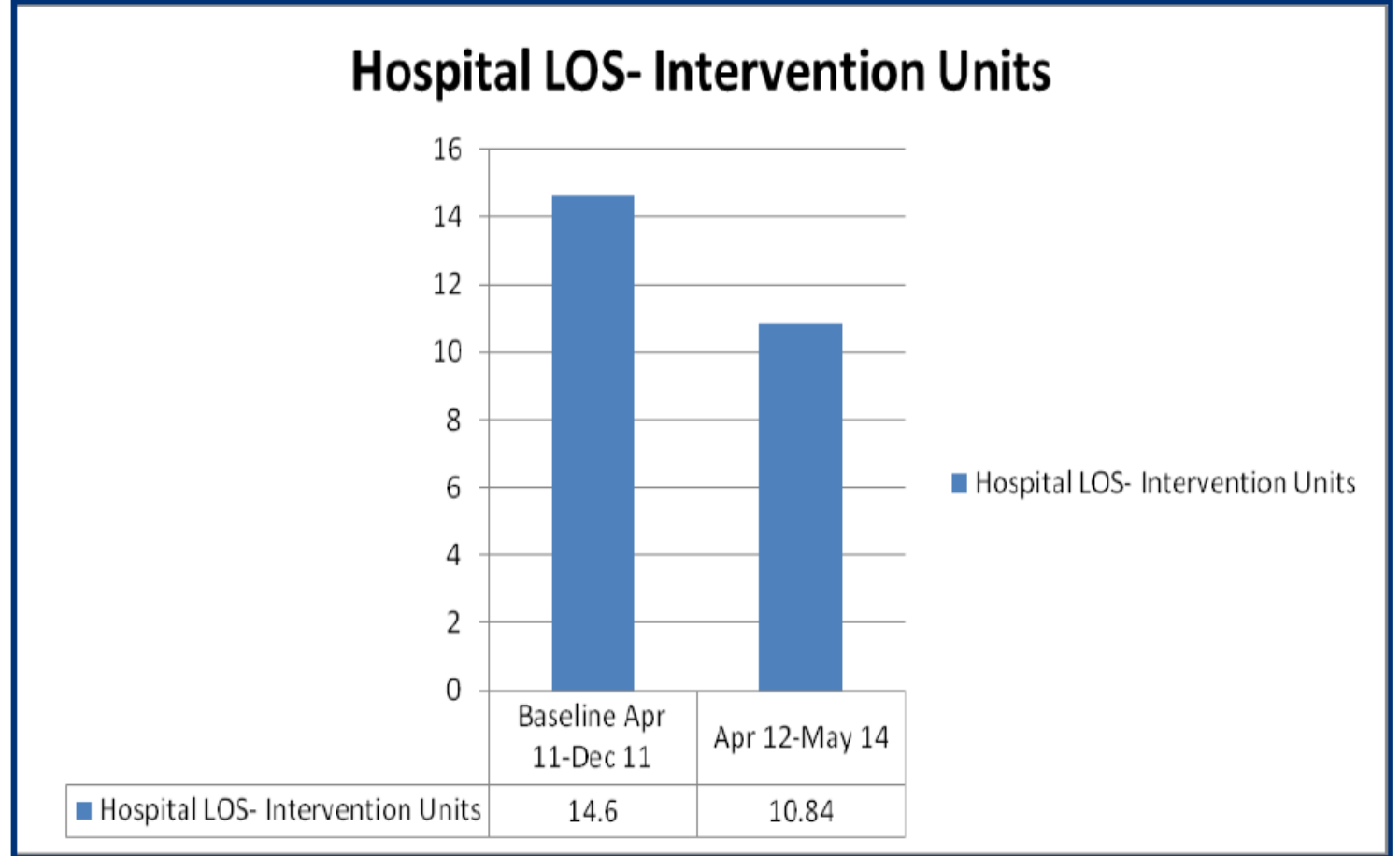
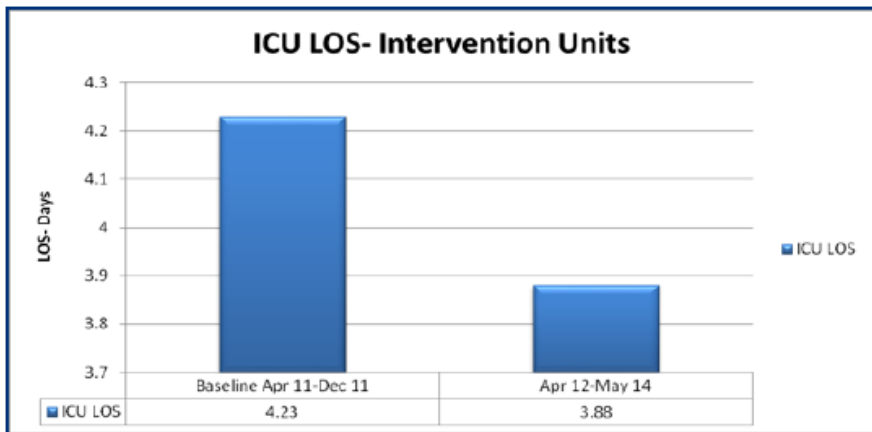
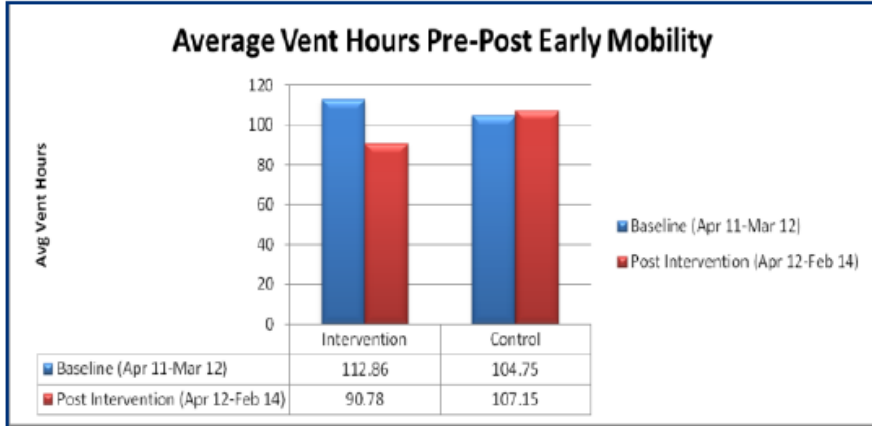
Improved V/Q with Active Diaphragm



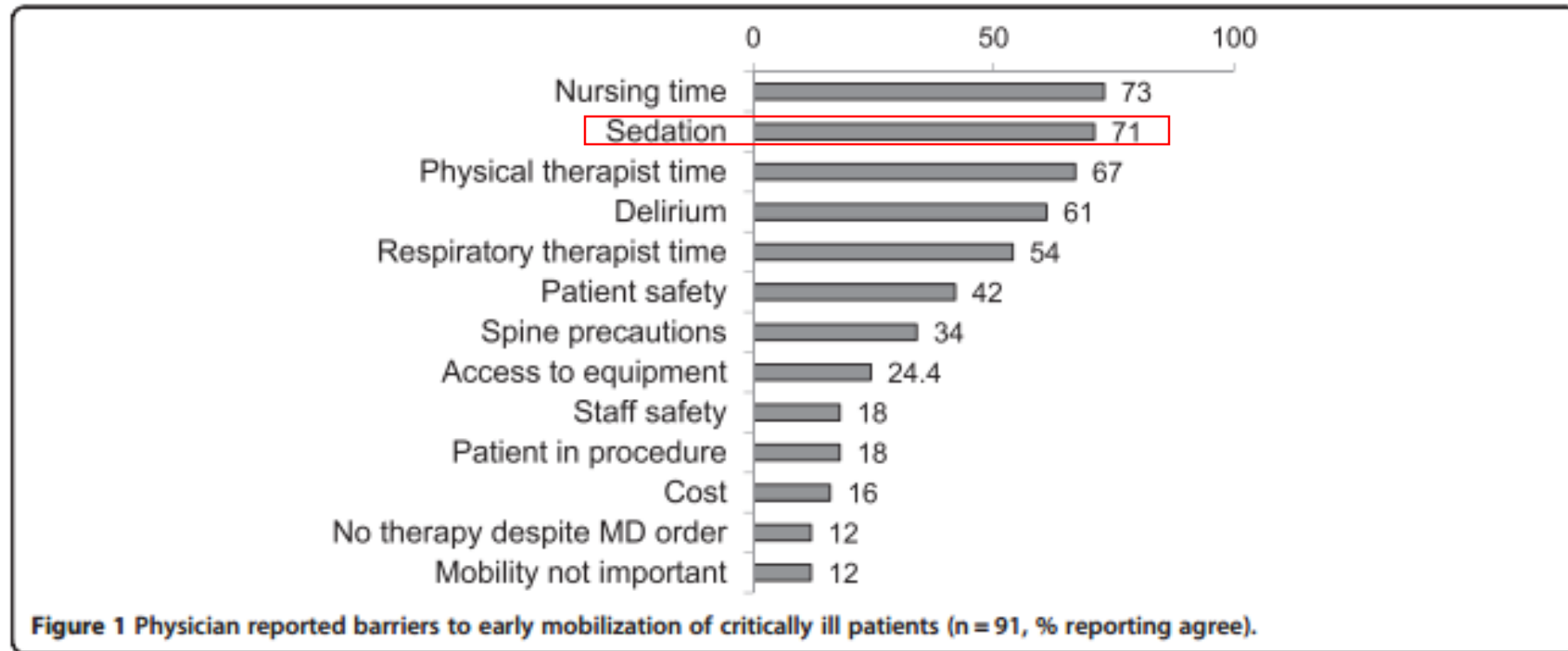
Diaphragmatic Dysfunction Develops Quickly with CMV



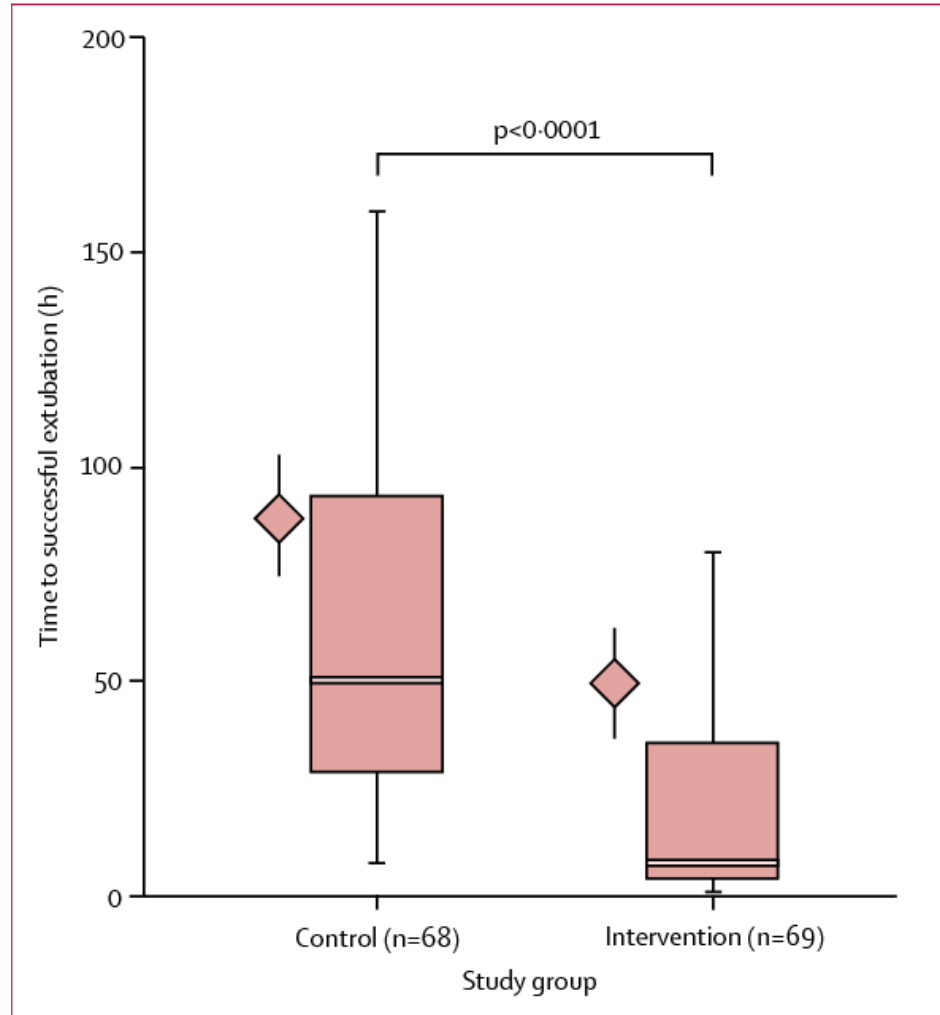
Early Mobility Improves Outcomes



Perceived Mobility Barriers - MDs



Ventilator Liberation Linked to Protocolized Sedation



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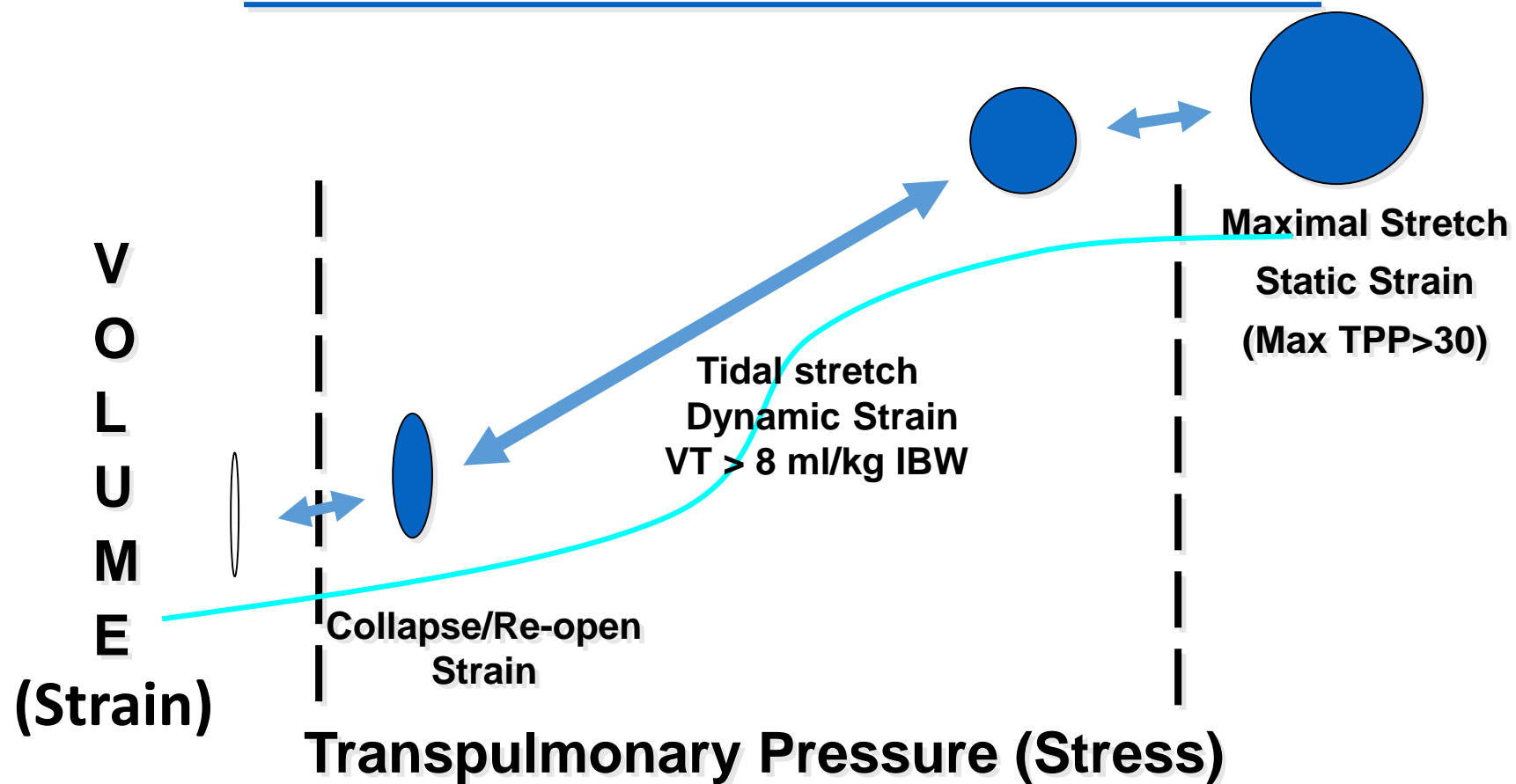
The Idea of Limiting Positive Pressure Tidal Volumes to “Normal Size” Is Not a New Idea

“Some had suggested a bellows, but blowing would be preferable.... as the lungs of one man may bear, without injury, as great a force as those of another man; which by the bellows cannot always be determined”

John Fothergill, Proc Roy Soc London 1744

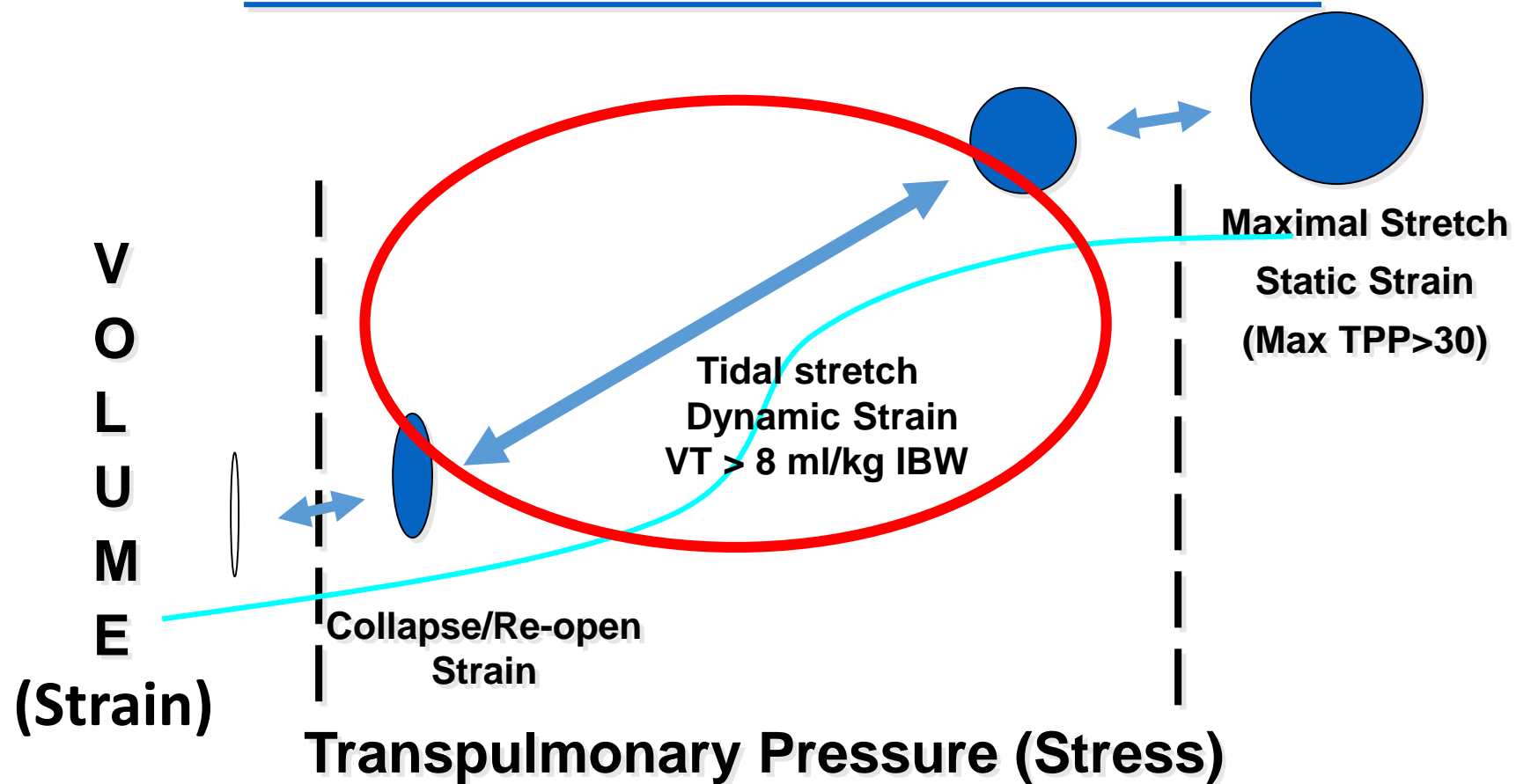
Lung Protection from VILI

Three Major Mechanisms



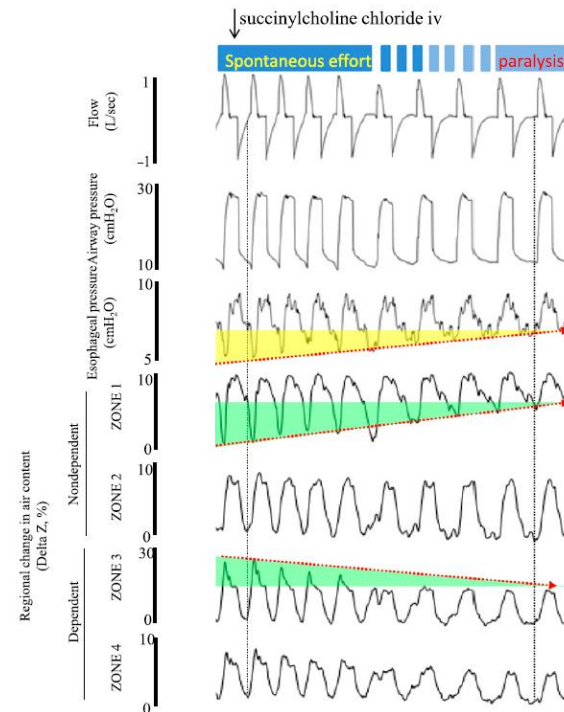
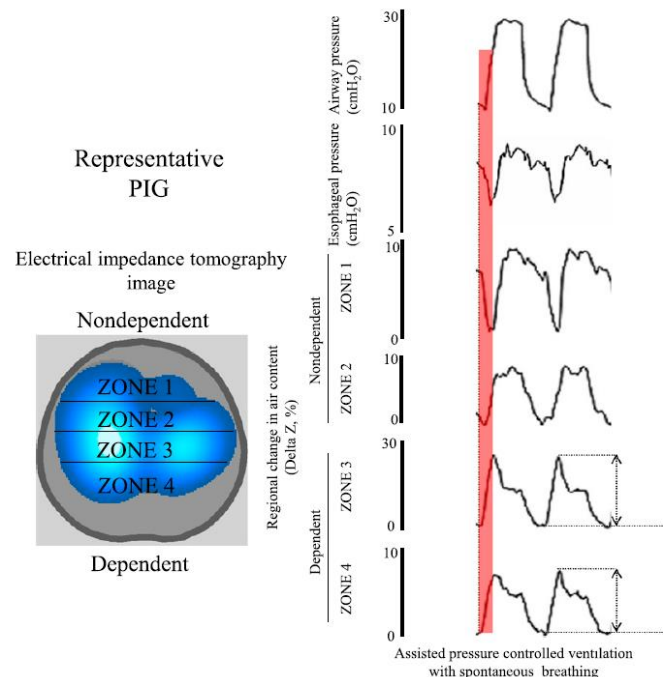
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It Is More than Just Excessive Global Strain (VT)

- Suspect excessive regional VT if DP > 13-19 cm H₂O, even if VT < 8ml/kg IBW and Pplat < 30 cm H₂O
- Situation compounded by spontaneous efforts creating negative pleural pressure resulting in pendelluft towards healthier regions at breath initiation.



Spontaneous Efforts – More Effects

- Negative pleural pressure may augment capillary leakage into alveoli
- Diaphragm may be overloaded
- Tachypnea may increase air trapping

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Fix the fixable, don't make it worse

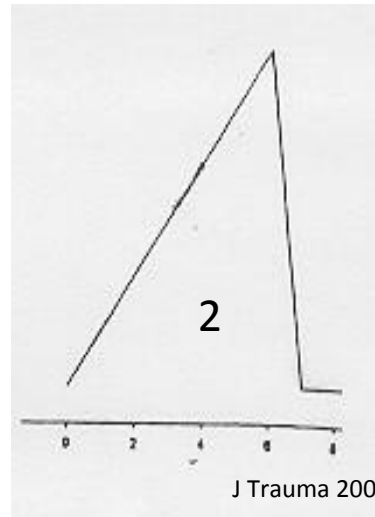
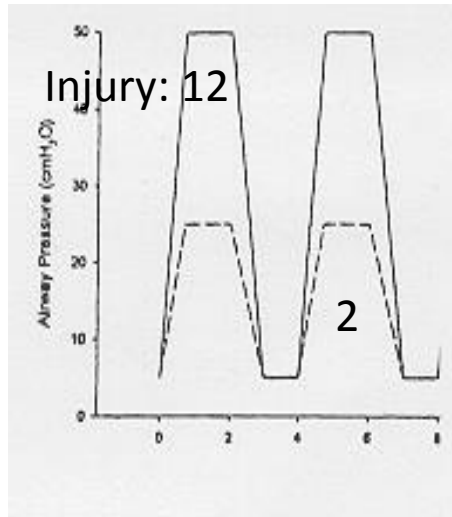
- Fix the fixable – address causes
- Don't make it worse
 - Minimize positive pressure support
 - HFNC vs NIV
 - Helmet NIV

Balance VILI Risk with Sedation Risks

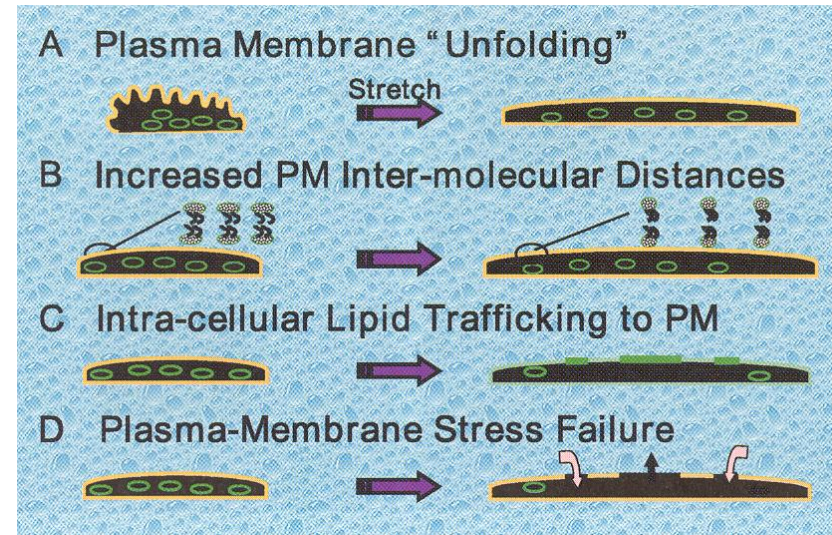
- Assess the risk
 - High if DP > 20 cm H₂O (can estimate with test breath), TPP plateau > 30 cm H₂O
- Sedate with goal of a lower risk VT
 - Should be reassessed frequently – spontaneous drive often stabilizes on its own
 - Paralysis is a last resort and the need should clearly be reassessed frequently

Final Thoughts - Can the Lungs Adapt?

- Theoretical considerations
 - Slower flows/acceleration forces may minimize VILI
 - Lung can “plug” cell membrane tears if tidal swings small



J Trauma 2000;49:903



Courtesy R Hubmayr

- Actual examples
 - Chronic NM disease – rapid shallow pattern for years
 - High altitude dwellers – chronic hyperventilation for lifetime

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(but sometimes a necessary evil)*