Mechanical Power
What, How, Why

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Outline

- What is Energy and Power
- What is Mechanical Power
- How to calculate it
- Relation to VILI
- Trans-Pulmonary Mechanical Power
- Trans-Alveolar Mechanical Power
- Role of new adaptive ventilation modes in reducing mechanical power and VILI
- Research
- Questions yet to be answered

Respiratory Physiology & Mechanics

- Understanding respiratory physiology and mechanics during mechanical ventilation is critical for monitoring patients and making accurate ventilator adjustments

- **Various factors have to be accounted for, including:**
  - Tidal volume
  - Driving pressure
  - Inspiratory flow
  - Respiratory rate, respiratory mechanics
  - Recently, mechanical power

Equation of Motion

Ventilation pressure (to deliver tidal volume)	=	**Elastic pressure** (to inflate lungs and chest wall)	+	**Resistive pressure** (to make air flow through the airways)	+	**PEEP** (to keep alveoli open)

$$P_{mus} + P_{vent} = P_{elastic} + P_{resistive} + \text{PEEP total}$$

$$P_{mus} + P_{vent} = E \times V + R \times V + \text{PEEP total}$$

Ventilator-Induced Lung Injury (VILI)

- VILI can be an adverse consequence of mechanical ventilation
- Multiple implications in the understanding of components of ventilator-induced lung injury, specifically alveolar stress (pressure), strain (volume), and mechanical power

  - Tidal volume (strain)
  - Pressure (stress)
  - Flow rates
  - Respiratory Rate
  - Inspiratory time
  - Mechanical power

Silva PL, Ball L, Rocco PRM, Pelosi P. Power to mechanical power to minimize ventilator-induced lung injury? Intensive Care Med Exp. 2019;7(Suppl 1):38.

Anjum F. Ventilator-Induced Lung Injury (VILI) [Updated 2022 Dec 11]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK563244/

Mechanical Power

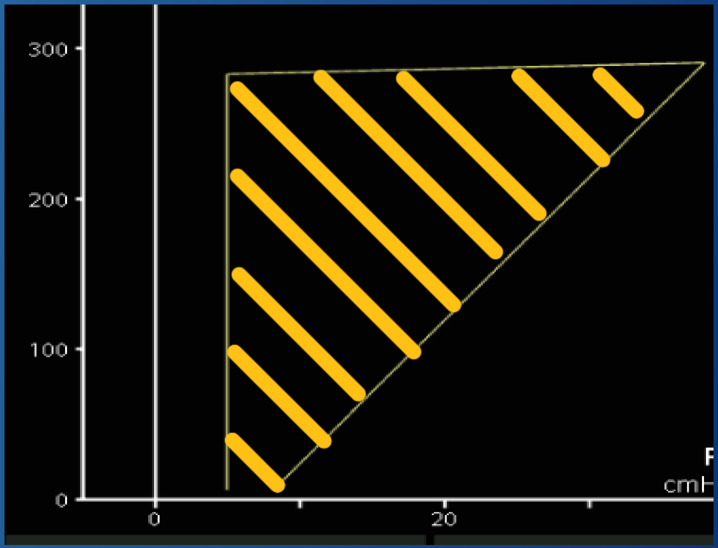
- The mechanical power (the energy delivered from the ventilator per minute) incorporates all the components delivered from the ventilator (VT, flow, inspiratory pressure, I-time, PEEP, RR)

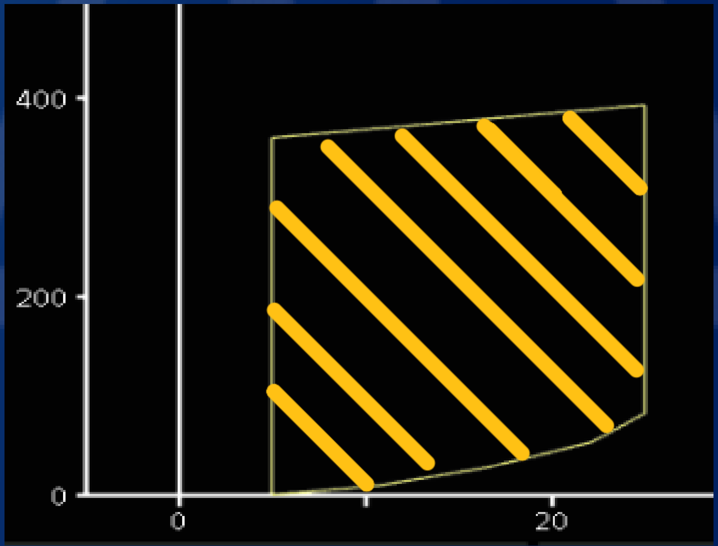
Gattinoni L, et al. Ventilator-related causes of lung injury: the mechanical power. Intensive Care Med. 2016 Oct;42(10):1567-1575.

Mechanical Power Components

- ***Energy*** = Work (Joule)
- ***Work*** = Force x Displacement
  = Pressure x Volume
- ***Power*** = Energy per time (Joules/minute)

Mechanical Power (J/minute) = 0.098 · RR (1/minute) · Pressure (cmH$_2$O) · V$_T$ (L)





Mechanical Power Components

How many times you get punched: RR

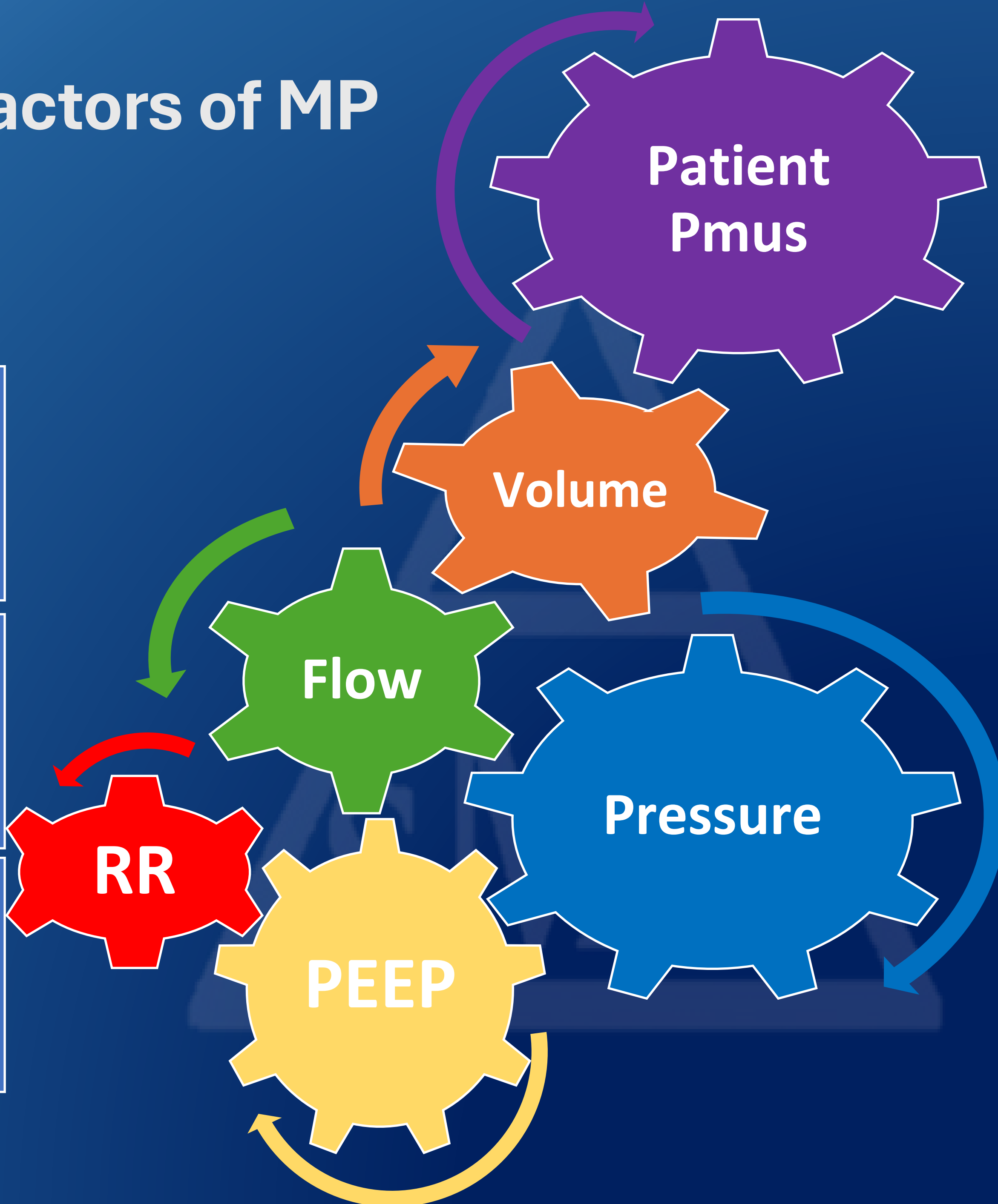
How strong are the punches: DP

How far the head bubbles after the hit: V_T / Flow

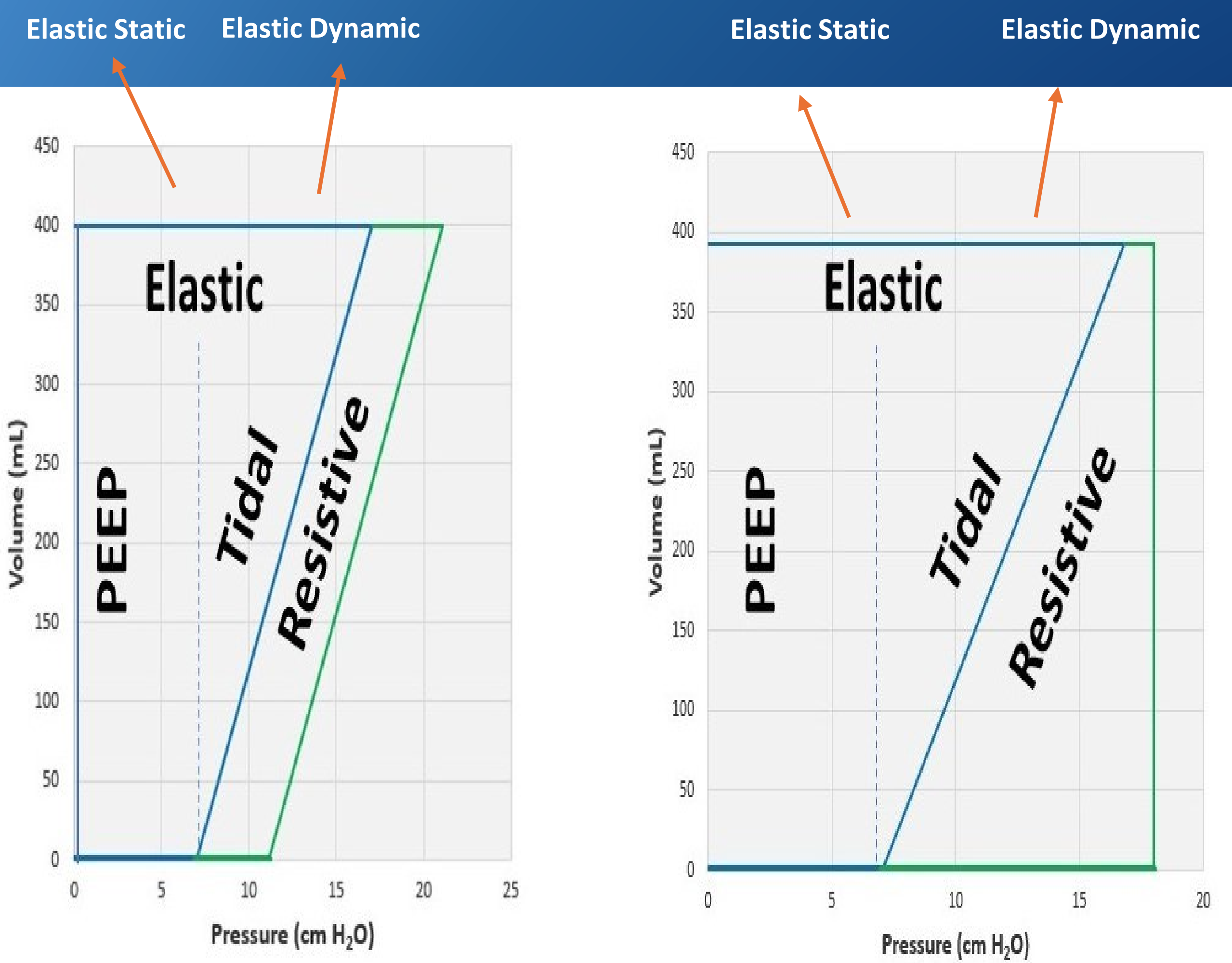
"It's not about how hard you hit. It's about how hard you can get hit and keep moving forward. How much you can take and keep moving forward"

VILI & Factors of MP

Barotrauma	Atelectrauma
Volutrauma	Ergotrauma
Biotrauma	Rheotrauma



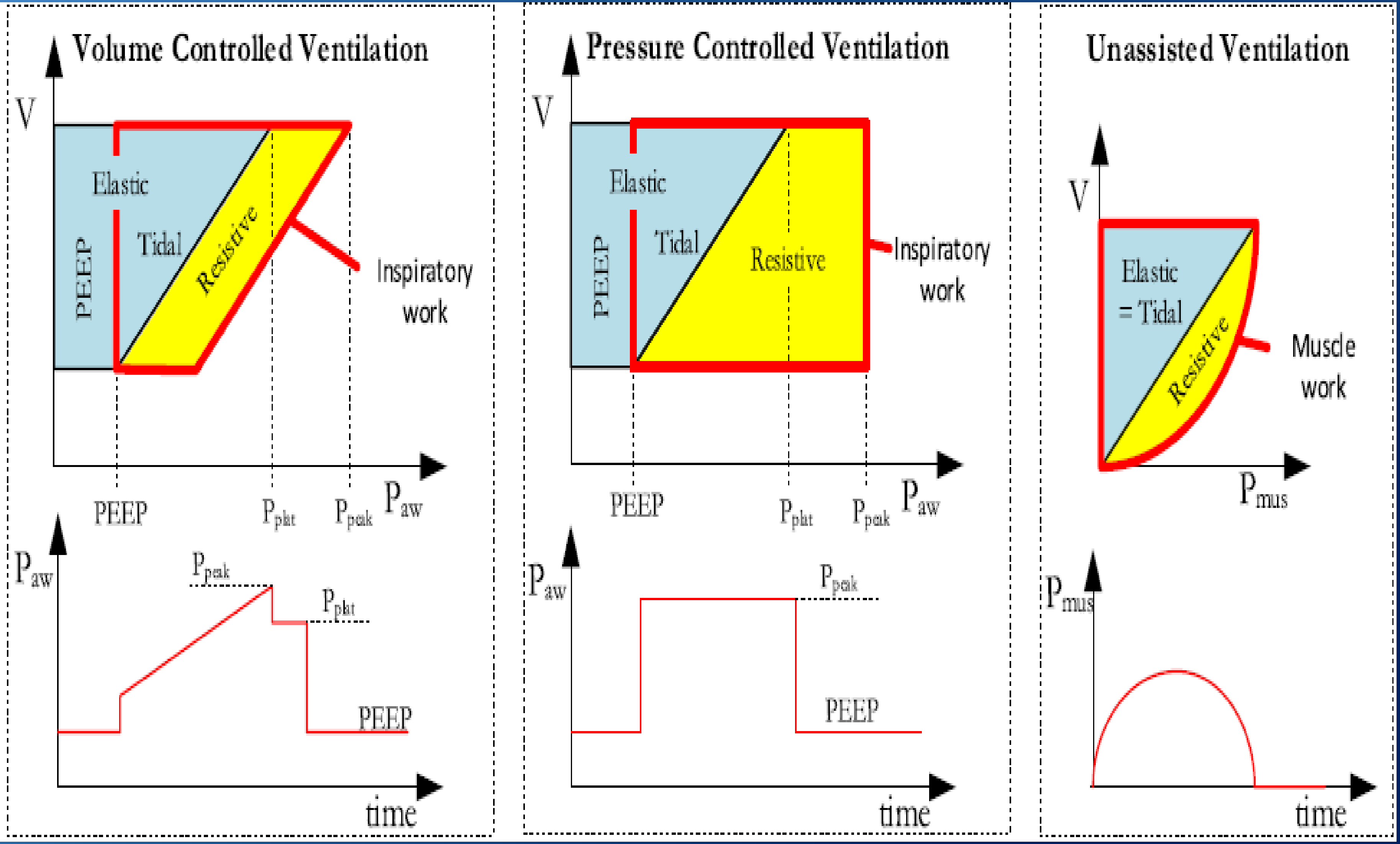
Components of Work



- **Resistive work:** Work dissipated (as heat) in generating flow through the airway resistance
- **Elastic work:** Work needed to expand the lungs and chest wall
- **PEEP work:** Work against PEEP during inspiration which is temporarily stored as energy within the elastic tissues.
- **Inspiratory work:** The sum of tidal work and resistive work
- **Tidal work:** Elastic work minus PEEP work
- **Total work:** Work generated by the ventilator to deliver pressure and flow to the respiratory system

van der Staay M, et al. Advanced modes of mechanical ventilation and optimal targeting schemes. Intensive Care Med Exp. 2018; 6(1):30

Pressure-Volume Curve



van der Staay M, Chatburn RL. Advanced modes of mechanical ventilation and optimal targeting schemes. Intensive Care Med Exp. 2018 Aug 22;6(1):30.

Calculations & Equations

			MECHANICAL POWER (J/MIN)					
			POWER OF INSPIRATION (cm$H_2$0.L/min)					Conversion factor
			WORK OF INSPIRATION (cm$H_2$0.L)				RR (BPM)	
			VOLUME X	PRESSURE (cm $H_2$0)				
				Elastic static component +	Elastic dynamic component +	Resistive component		
VCV	Simplified equation	Gattinoni et al	ΔV	Peak pressure- (plateau pressure- PEEP) / 20			RR	0.098
	Surrogate	Giosa et al	ΔV	(Peak pressure + PEEP+F/6) /20			RR	0.1
PCV	Surrogate	Becher et al	ΔV	PEEP	Pinsp. $(1 - e^{-Tinsp/T})$		RR	0.098
	Simplified equation	Becher et al	ΔV	PEEP	Pinsp		RR	0.098

Paul G, et al. 4DPRR- Index for predicting mortality in COVID-19 ARDS. J Mech Vent 2022; 3(2):56-60.

Giosa L, et al. Mechanical power at a glance: a simple surrogate for volume-controlled ventilation. Intensive Care Med Exp. 2019;7(1):61.

Becher T,. Calculation of mechanical power for pressure-controlled ventilation. Intensive Care Med. 2019 Sep;45(9):1321-1323.

Calculation

Mechanical Power in VC & PCV

$$\text{Power} = \frac{\text{Exp Min Vol} \times (\text{Ppeak} + \text{PEEP/CPAP} + \text{Insp Flow}/6)}{20}$$

$$MP_{PCV} = 0.098 \cdot RR \cdot VT \cdot (\triangle P_{insp} + PEEP)$$

$$\frac{5.8 \times (23 + 5 + 43/6)}{20} = 10.2 \text{ J/min}$$

$$0.098 \times 12 \times 0.498 \times 20 = 11.71 \text{ J/min}$$

Mean airway pressure – Minute ventilation equation mM

Journal of Mechanical Ventilation

Mean airway pressure - Minute ventilation product (mM): A simple and universal surrogate equation to calculate mechanical power in both volume and pressure controlled ventilation

Ehab G. Daoud, [1] Philip Lee, [2] Shane Toma, [3] Claudio L. Franck [4]

Mean airway pressure – Minute ventilation equation mM

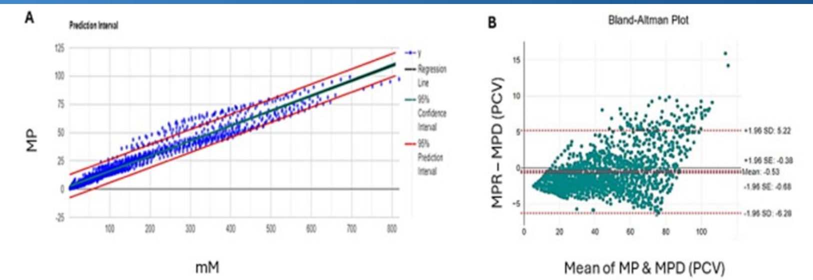


Figure 4A (left): Correlation between measured mechanical power (MPR) by simulator and the mM equation in PCV.
Figure 4B (right): Bland-Altman plot comparing the measured mechanical power (MPR) by simulator to the MP derived (MPD) from the mM equation in the PCV.

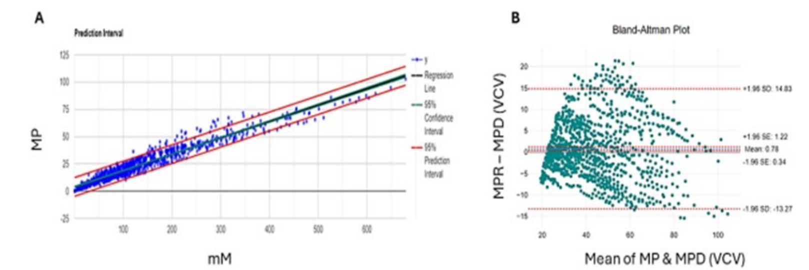
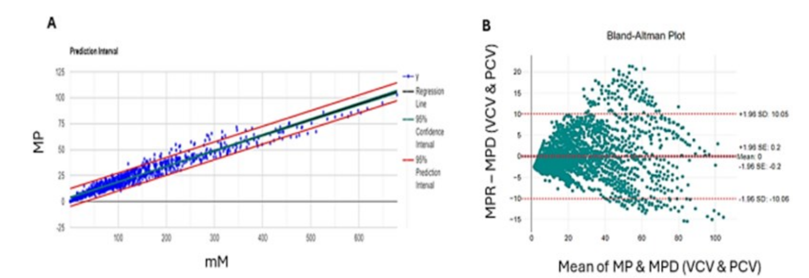
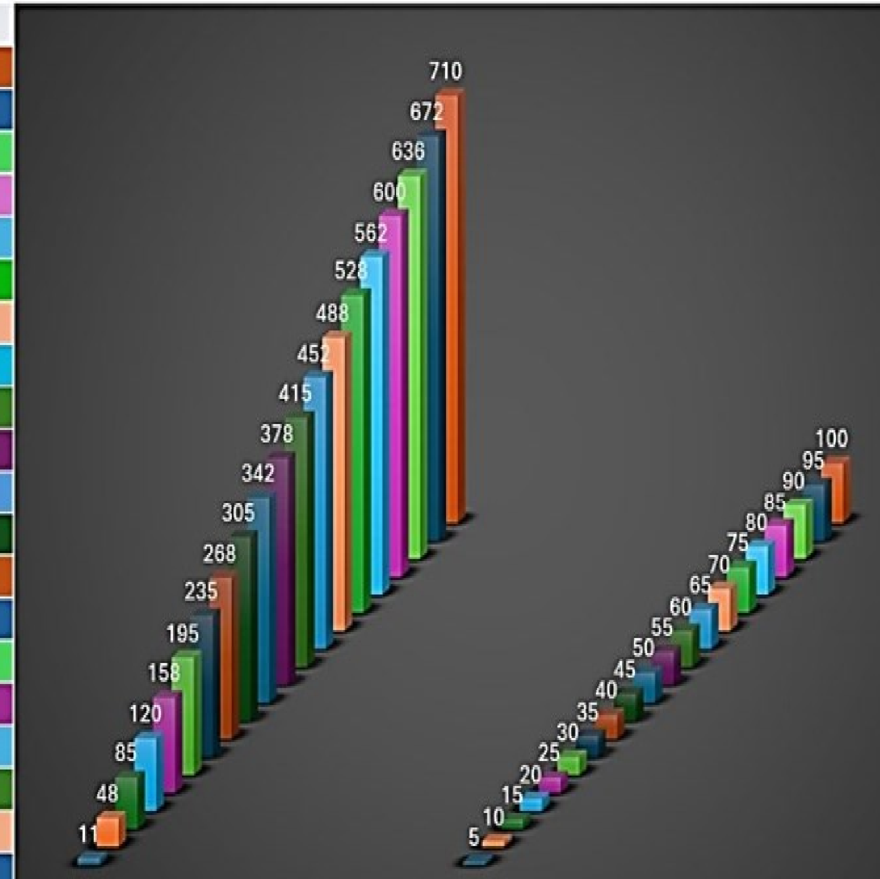


Figure 5A (left): Correlation between measured mechanical power (MPR) by simulator and the mM equation in VCV.
Figure 5B (right): Bland-Altman plot comparing the measured mechanical power (MPR) by simulator to the MP derived (MPD) from the mM equation in the VCV.



For both modes MP = 0.13 (mM) + 3.41
For PCV MP = 0.15 (mM) + 3.79
For VCV MP = 0.13 (mM) + 2.48

mM	MP
710	100
672	95
636	90
600	85
562	80
528	75
488	70
452	65
415	60
378	55
342	50
305	45
268	40
235	35
195	30
158	25
120	20
85	15
48	10
11	5



Daoud EG, Lee P, Toma S, Franck CL. Mean airway pressure - Minute ventilation product (mM): A simple and universal surrogate equation to calculate mechanical power in both volume and pressure controlled ventilation. J Mech Vent 2024; 5(2):46-55.

Mean airway pressure – Minute ventilation equation mM

Journal of Mechanical Ventilation

Evaluation of the mean airway pressure - Minute ventilation (mM) Equation for mechanical power during spontaneous breathing

Philip M Lee, [1] Kira Morikawa, [1] Ehab G Daoud [2]

PCV

Ventilator power = 0.142 (mM)

Total power = 0.18 (mM) + 5.427

Pmus power = 0.037 (mM) + 2.415

VCV

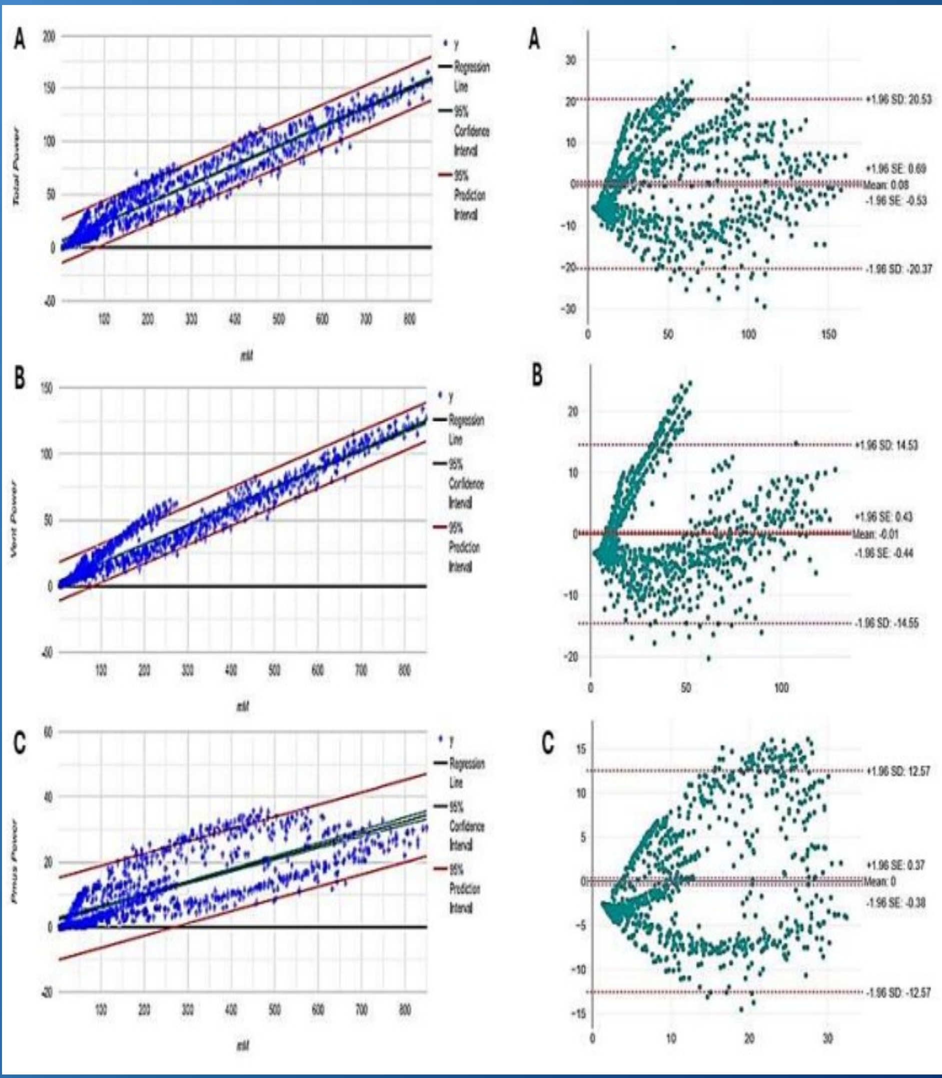
Ventilator power = 0.148 (mM) + 3.10)

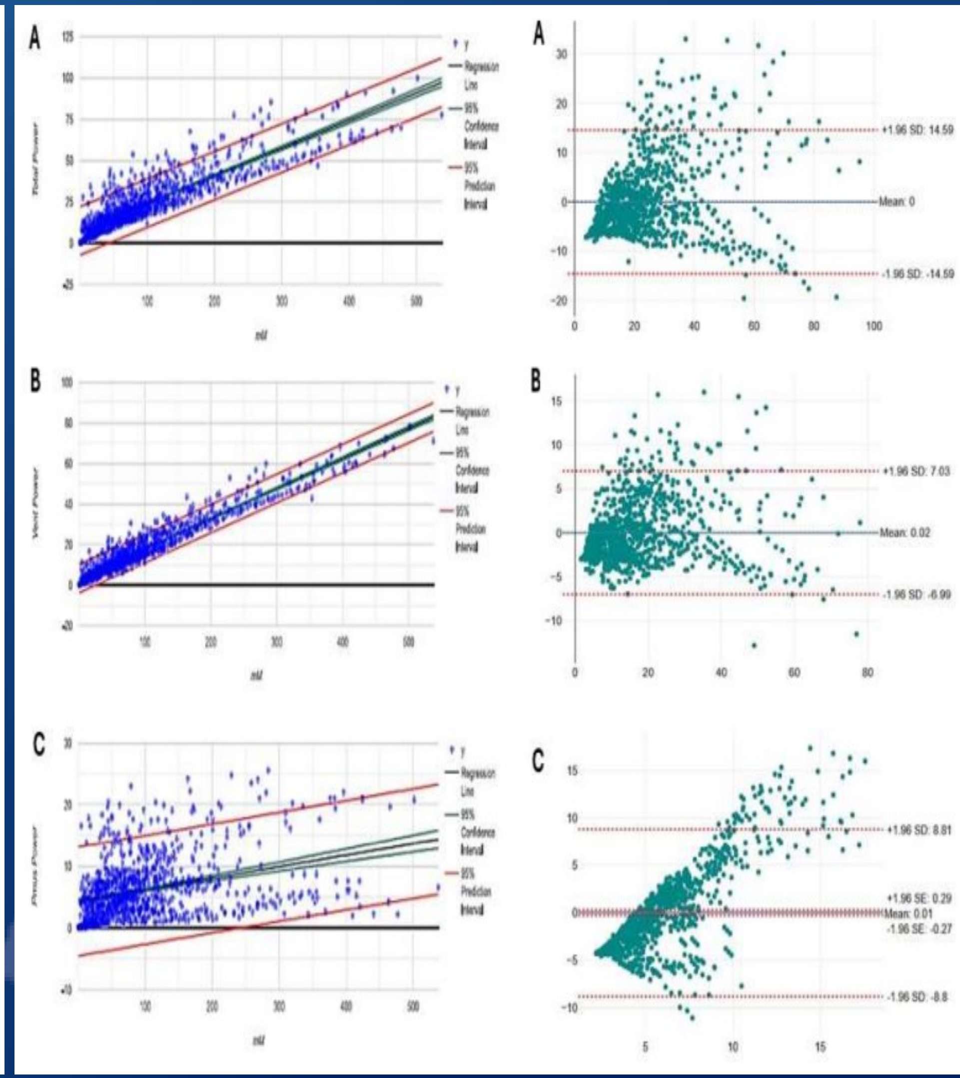
Total power = 0.167 (mM) + 7.38

Pmus power = 0.018 (mM) + 4.284

: Lee PM, Morikawa K, Daoud EG. Evaluation of the mean airway pressure - minute ventilation (mM) Equation for mechanical power during spontaneous breathing. J Mech Vent 2025; 6(2):72-78.

Mean airway pressure – Minute ventilation equation mM





: Lee PM, Morikawa K, Daoud EG. Evaluation of the mean airway pressure - minute ventilation (mM) Equation for mechanical power during spontaneous breathing. J Mech Vent 2025; 6(2):72-78.

Calculators

https://societymechanicalventilation.org/calculators/

Mechanical Power in Volume Controlled Ventilation with constant flow (mM) (Daoud, et al)

Mean Airway Pressure [ ] cmH2O

Minute Ventilation [ ] L/min

Calculate Reset

Equation: MP = 0.13 (mM) + 2.48

Reference: Mean airway pressure – Minute ventilation product (mM): A simple and universal surrogate equation to calculate mechanical power in both volume and pressure controlled ventilation

Mechanical Power in Pressure Controlled Ventilation

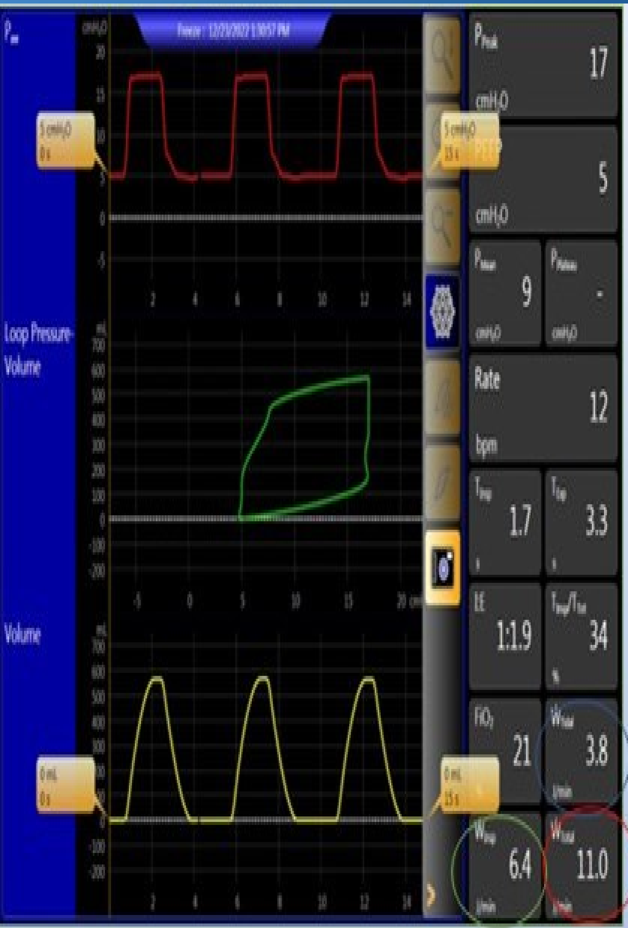
(mM) (Daoud, et al)

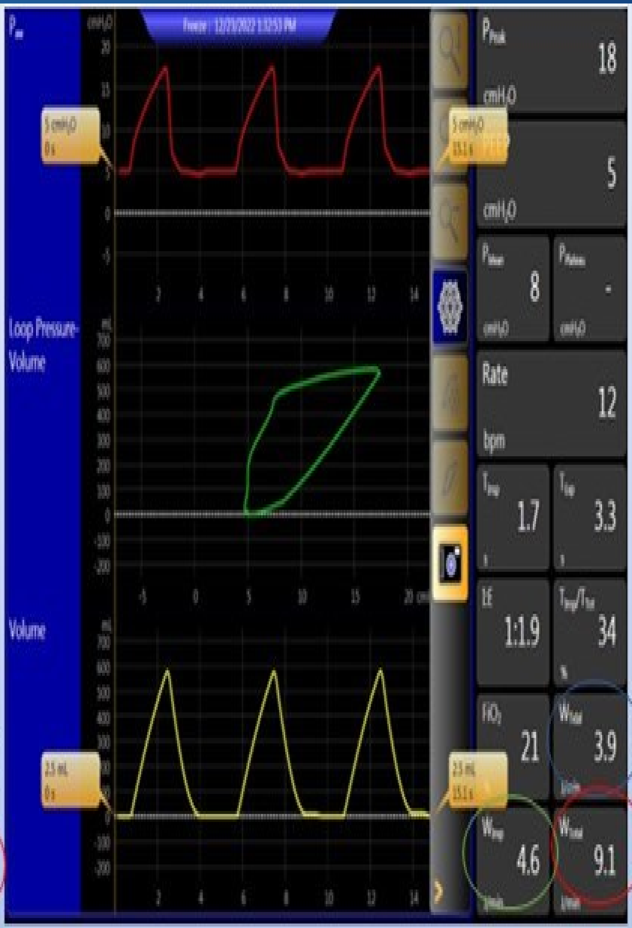
Mean Airway Pressure [ ] cmH2O

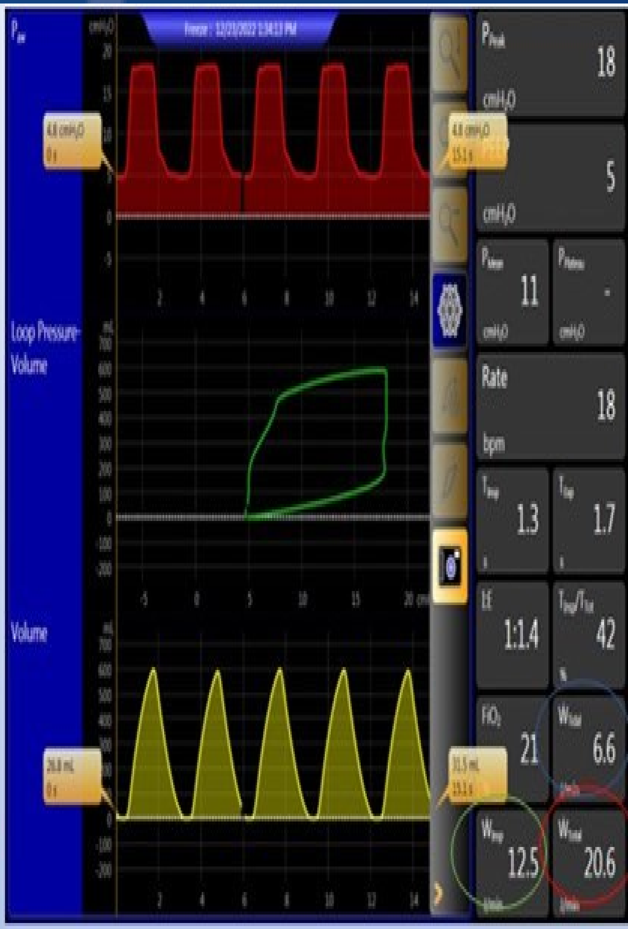
Minute Ventilation [ ] L/min

Calculate Reset

Automatic Calculation





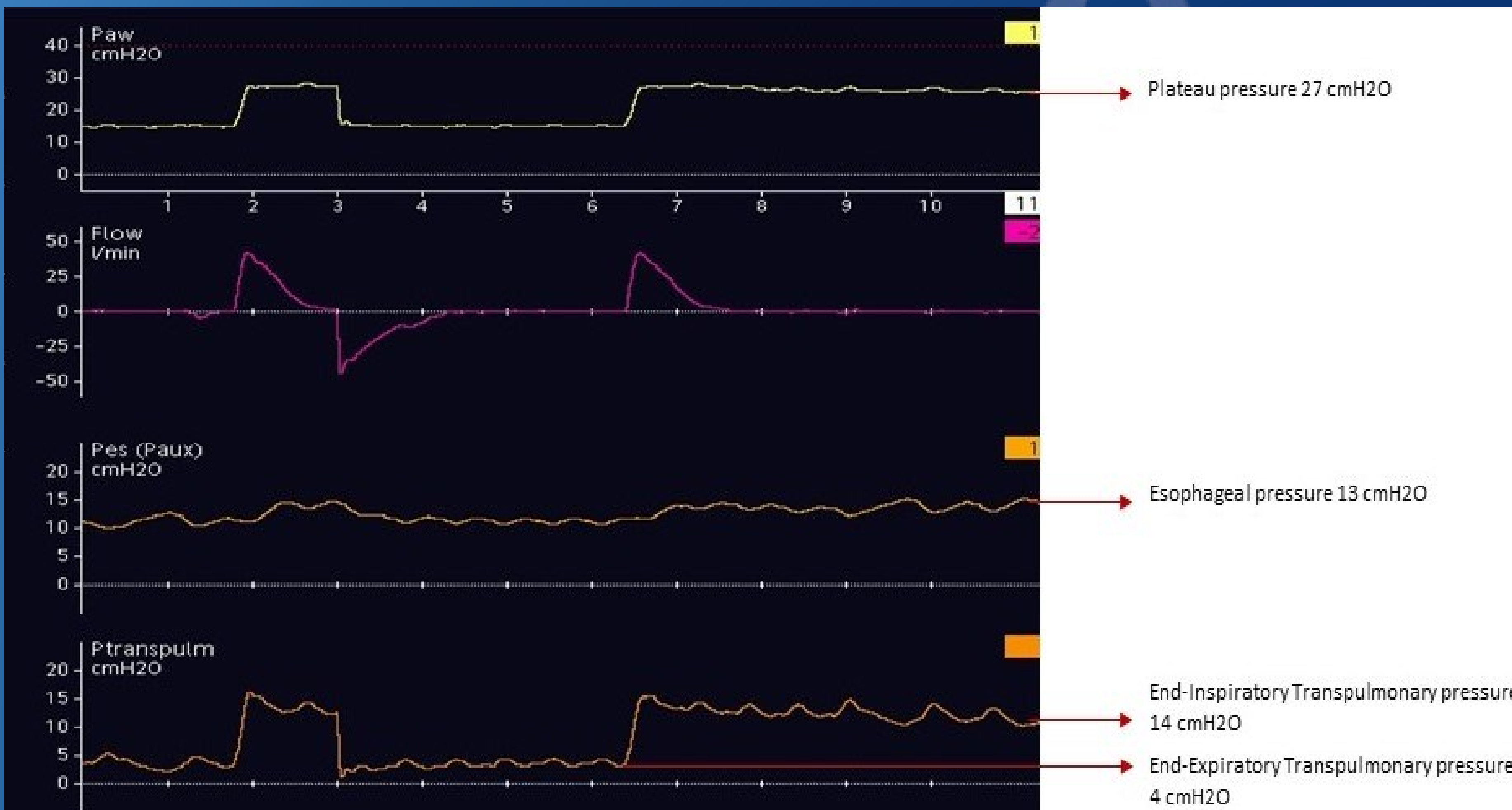


PCV **VCV** **PSV**

Automatic Calculation

Trans-Pulmonary Mechanical Power

$$MP_L = 0.098 \cdot RR \cdot \{VT^2 \cdot \frac{1}{2} \cdot E_L + VT \cdot PEEP\}$$



Trans-Alveolar Mechanical Power

Alveolar compliance

214 / 10

21.4 ml/cmH_2O

Alveolar flow

0.214 / 1.2

17.83 L/min

Alveolar resistance

12 -11 / (17.83 / 60)

3.36 cmH_2O/L/s

Trans-Alveolar MP

$MPAlv = (0.098 \times RR) \times \{2\ V_{TAlv} \times \frac{1}{2} E_{Alv} + (V_{TAlv} \times PEEP)\}$

(0.098 x 15) x {0.428 X ½ (42) + (0.214 X 15)}

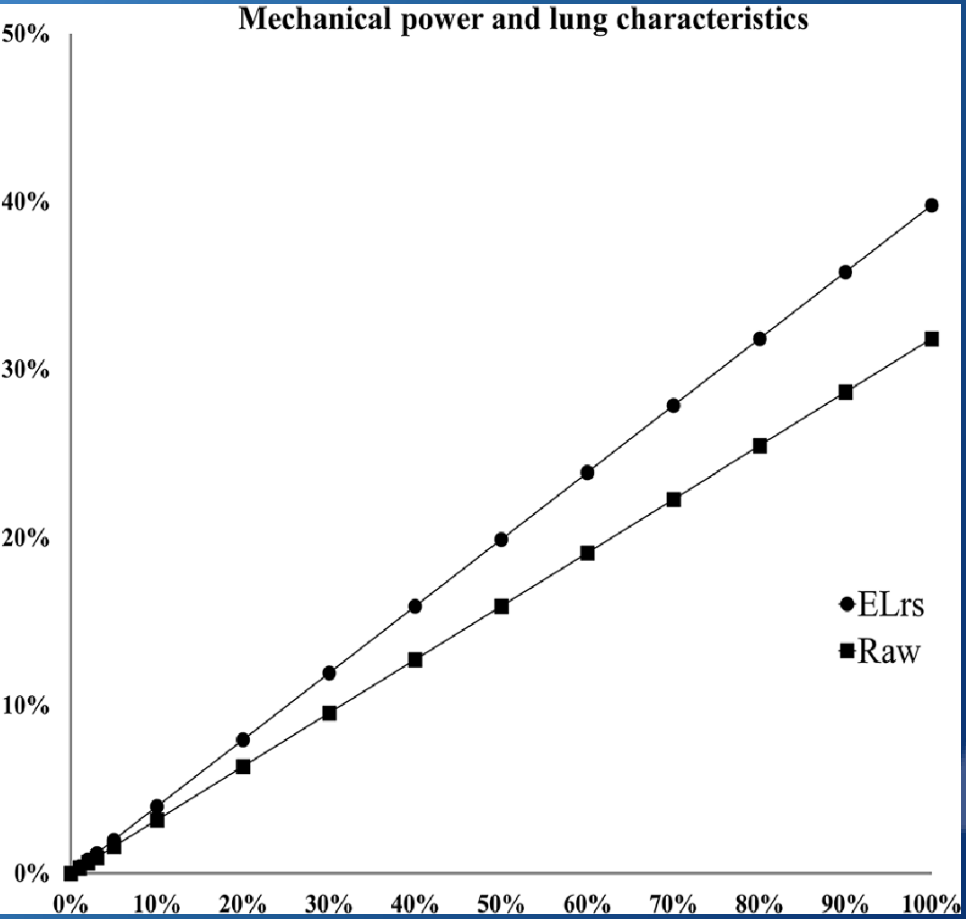
17.92 J/min

Daoud EG, Franck CL. Alveolar mechanics: A New Concept in Respiratory Monitoring. J Mech Vent 2022; 3(4):178-188.

Indexing the Power

IBW
Compliance
FRC
Total lung volume

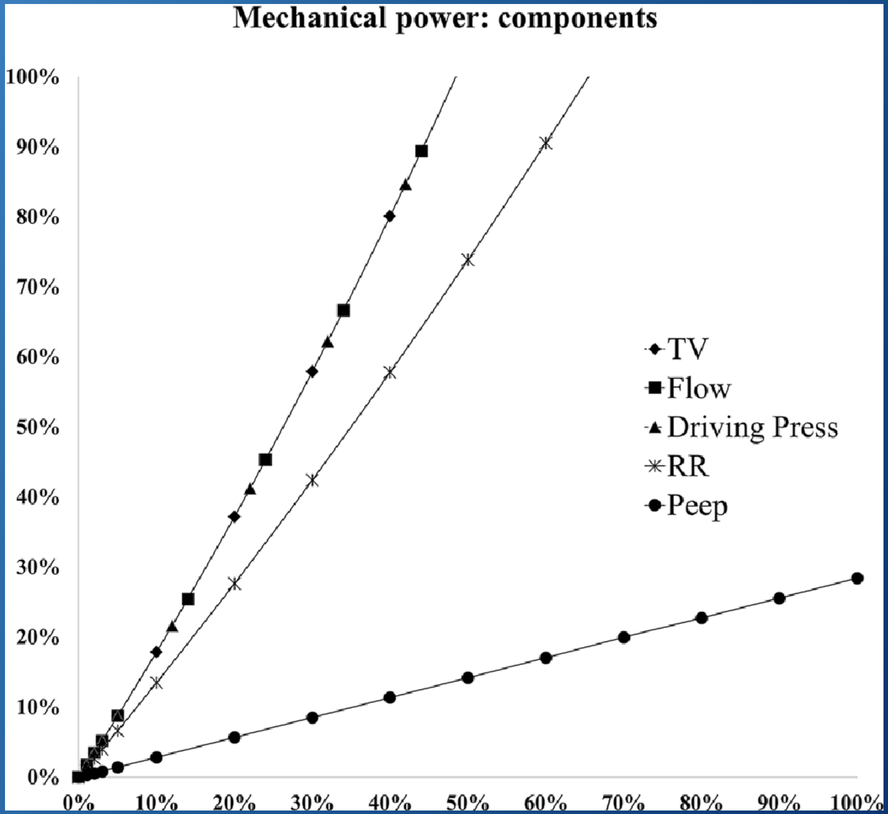
Relation of Mechanical Power with Elastance and Resistance



- The percent variations of mechanical power as a function of ELrs (*circles*) and *R*aw (*squares*)
- The variations of mechanical power with *R*aw are lower than those with ELrs
- While the mechanical power increases by 8 % with a 20 % increase of ELrs, it increases by 6 % with a 20 % increase of *R*aw, respectively
- All the computations were done by changing one variable at a time while keeping all the others constant

Gattinoni L, Ventilator-related causes of lung injury: the mechanical power. Intensive Care Med. 2016 Oct;42(10):1567-1575.

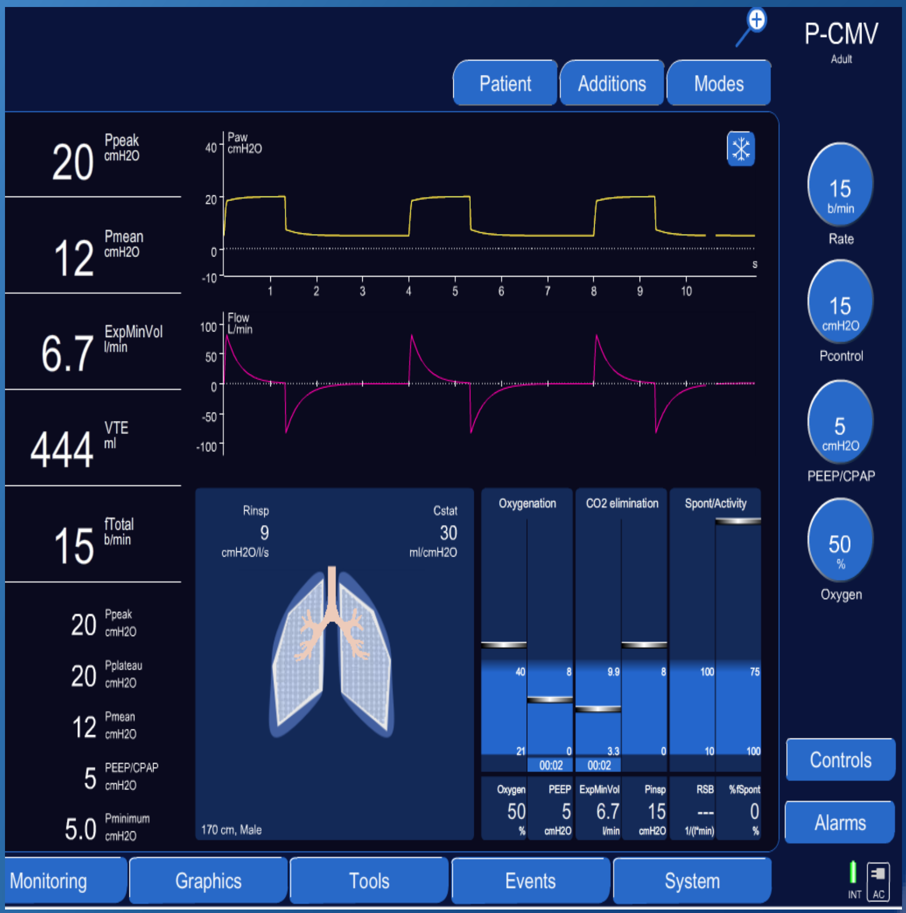
Relation of Mechanical Power with Ventilatory Components



- The percent increase of mechanical power as a function of TV/Δ*P*aw/inspiratory flow (***diamonds***, ***squares,*** and ***triangles***), RR (***stars***), PEEP (***circles***).
- The variations of mechanical power with TV, Δ*P*aw, and inspiratory flow are exactly the same, lying on the same line.
- While the mechanical power increases by 37% with a 20% increase of TV/Δ*p*aw/inspiratory flow, it increases by 27% and by 5.7% with a 20% increase in respiratory rate and PEEP, respectively.
- All the computations were done by changing one variable at a time while keeping all the others constant.

Mechanical Power and Adaptive modes

ASV

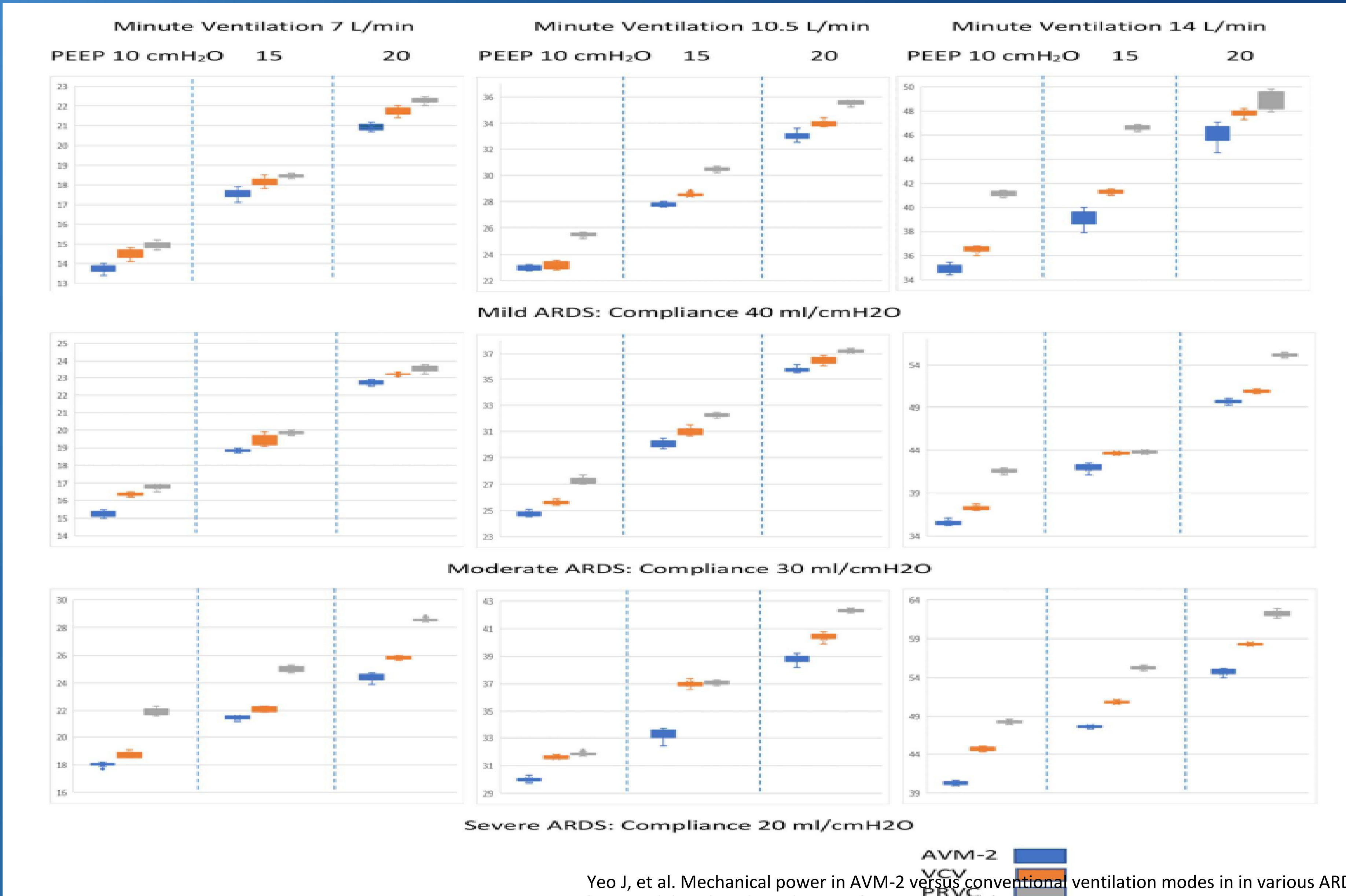


12.96 J/min

11.96 J/min

Arnal JM, et al. Airway and transpulmonary driving pressures and mechanical powers selected by INTELLiVENT-ASV in passive, mechanically ventilated ICU patients. Heart Lung. 2020; 49(4):427-434.

Mechanical Power and Adaptive modes AVM



Yeo J, et al. Mechanical power in AVM-2 versus conventional ventilation modes in in various ARDS lung models: A bench study. J Mech Vent 2022; 3(3):110-122.

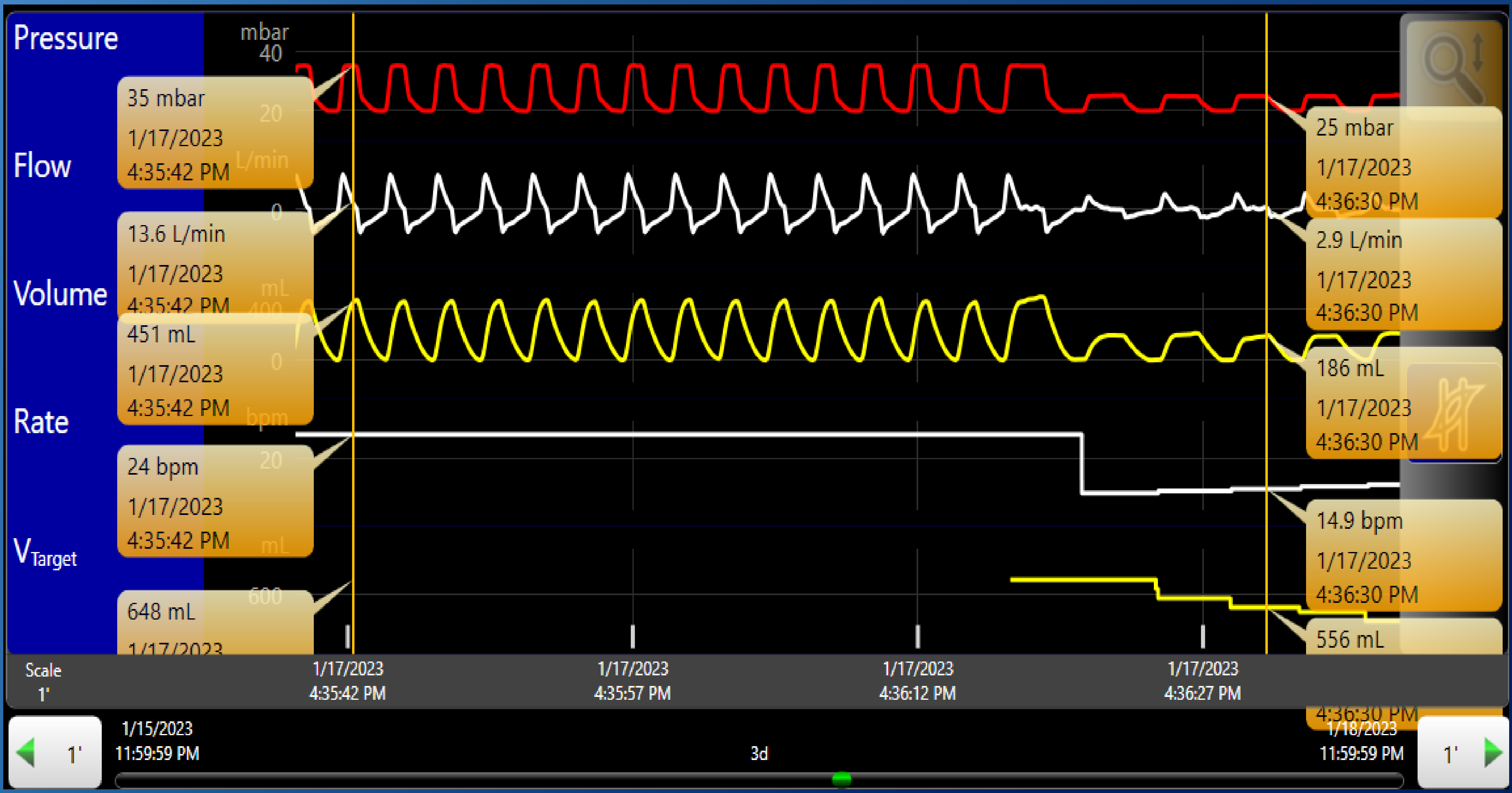
Mechanical Power and Adaptive modes

Parameter	AVM	AVM2	p value
V_T (ml/kg)	8.2 ± 0.6	7.2 ± 0.9	< 0.0001
ΔP_{stat} (cmH_2O)	12.6 ± 2.5	11.5 ± 1.6	0.0022
P_{insp} (cmH_2O)	23.9 ± 3.5	20.7 ± 2.8	< 0.0001
RR (1/min)	12.9 ± 1.7	15.8 ± 2.6	< 0.0001
Mechanical Power (J/min)	18.6 ± 4.6	16.8 ± 3.9	0.0024
$\dot{V}_A$	4.5 ± 0.9	4.6 ± 1.0	0.71
$P_{aw,mean}$ (cmH_2O)	14.0 (12.9–14.6)	14.6 (13.6–16.1)	0.0008
C_{rs} (ml/cmH_2O)	51.8 ± 12.1	47.7 ± 12.2	0.0043
R_{insp} ($cmH_2O/l/s$)	11.1 ± 2.3	10.0 ± 1.7	0.0004
RC_e (s)	0.82 ± 0.22	0.83 ± 0.26	0.68
PaO_2/FiO_2 (mmHg)	291 ± 102	270 ± 98	0.03
$PaCO_2$ (mmHg)	38.4 ± 4.2	39.1 ± 5.8	0.33
pH	7.46 ± 0.07	7.46 ± 0.07	0.37
MAP (mmHg)	84 ± 12	83 ± 12	0.87
HR (1/min)	70 ± 18	71 ± 18	0.42

Parameter	AVM	AVM2	p value
V_T (ml/kg)	7.9 ± 0.5	6.6 ± 0.8	< 0.0001
ΔP_{stat} (cmH_2O)	13.3 ± 2.7	11.8 ± 1.7	0.0044
P_{insp} (cmH_2O)	23.0 ± 2.6	20.5 ± 2.0	< 0.0001
RR (1/min)	13.0 ± 2.0	16.3 ± 2.9	0.0001
Mechanical Power (J/min)	17.5 ± 4.6	15.6 ± 3.2	0.006
$\dot{V}_A$	4.1 ± 0.7	3.9 ± 0.9	0.26
$P_{aw, mean}$ (cmH_2O)	13.7 ± 0.9	14.3 ± 1.1	0.11
C_{rs} (ml/cmH_2O)	47.3 ± 9.1	43.8 ± 11.9	0.12
R_{insp} ($cmH_2O/l/s$)	10.8 ± 2.7	9.5 ± 1.6	0.02
RC_e (s)	0.73 ± 0.18	0.71 ± 0.23	0.53
PaO_2/FiO_2 (mmHg)	218 ± 61	195 ± 55	0.01
$PaCO_2$ (mmHg)	38.5 ± 4.0	40.2 ± 6.1	0.19
pH	7.44 ± 0.08	7.43 ± 0.08	0.18
MAP (mmHg)	82 ± 12	81 ± 12	0.75
HR (1/min)	63 ± 11	64 ± 11	0.42

Becher T, et al. Adaptive mechanical ventilation with automated minimization of mechanical power-a pilot randomized cross-over study. Crit Care. 2019 Oct 30;23(1):338.

Mechanical Power and Adaptive modes
AVM



PCV vs AVM mode clinical trial

A comparative analysis of mechanical power and Its components in pressure-controlled ventilation mode and AVM-2 mode

Kensuke Takaoka, [1] Shane Toma, [2] Philip Lee, [1] Ehab G Daoud [3]

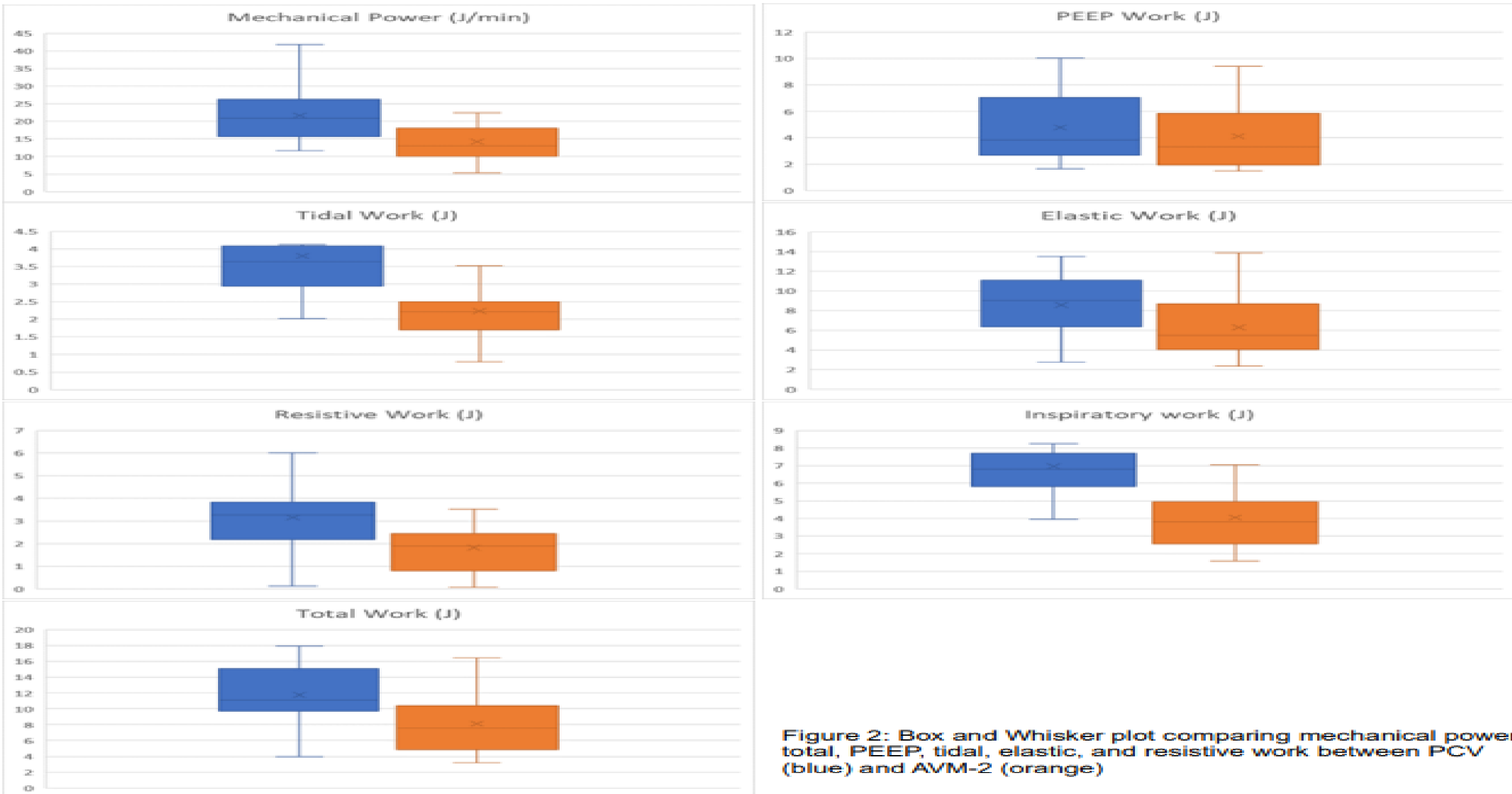


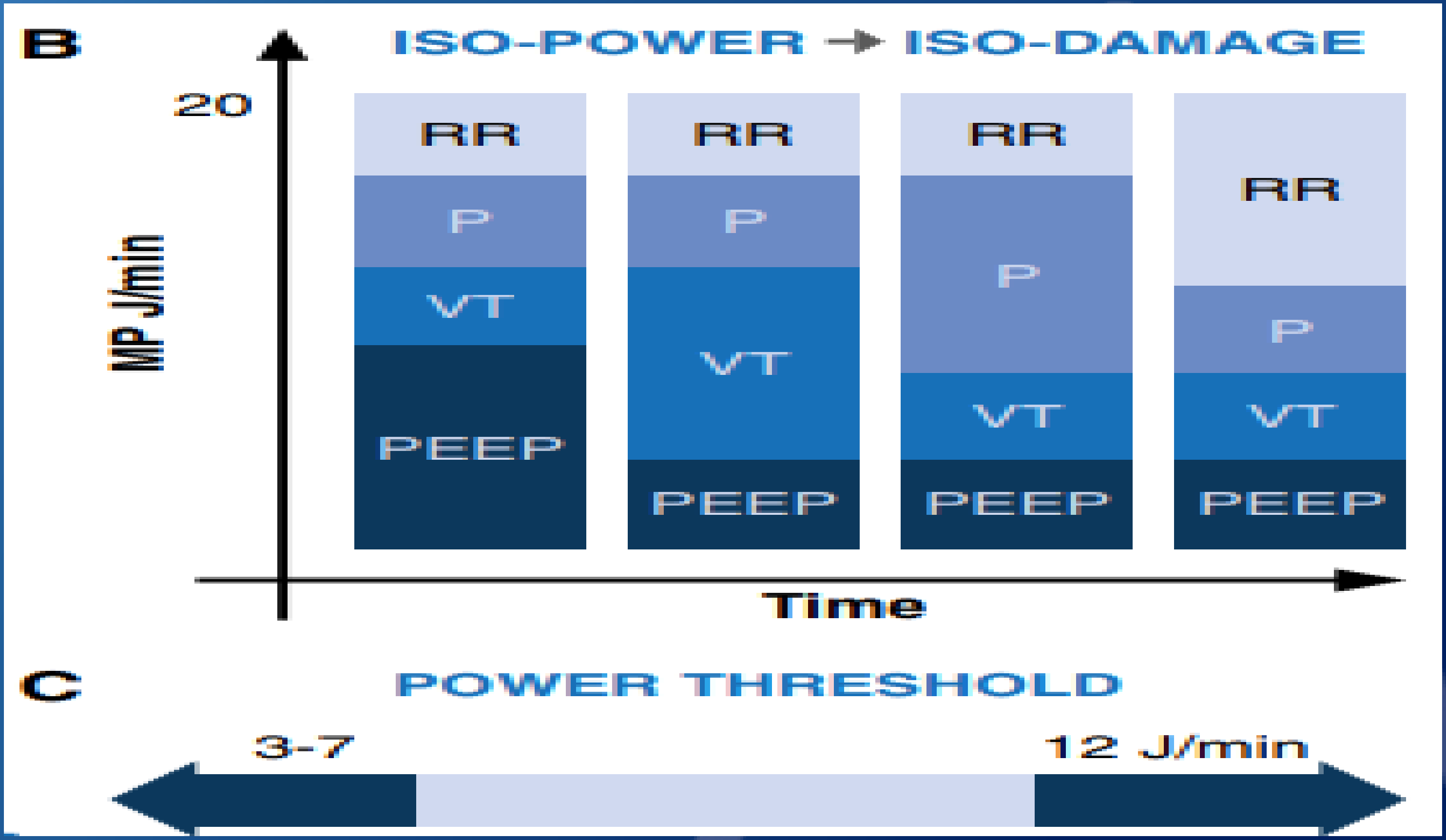
Figure 2: Box and Whisker plot comparing mechanical power, total, PEEP, tidal, elastic, and resistive work between PCV (blue) and AVM-2 (orange)

Takaoka K, Toma S, Lee P, Daoud EG. A comparative analysis of mechanical power and Its components in pressure-controlled ventilation mode and AVM-2 mode. J Mech Vent 2023; 4(4):130-140.

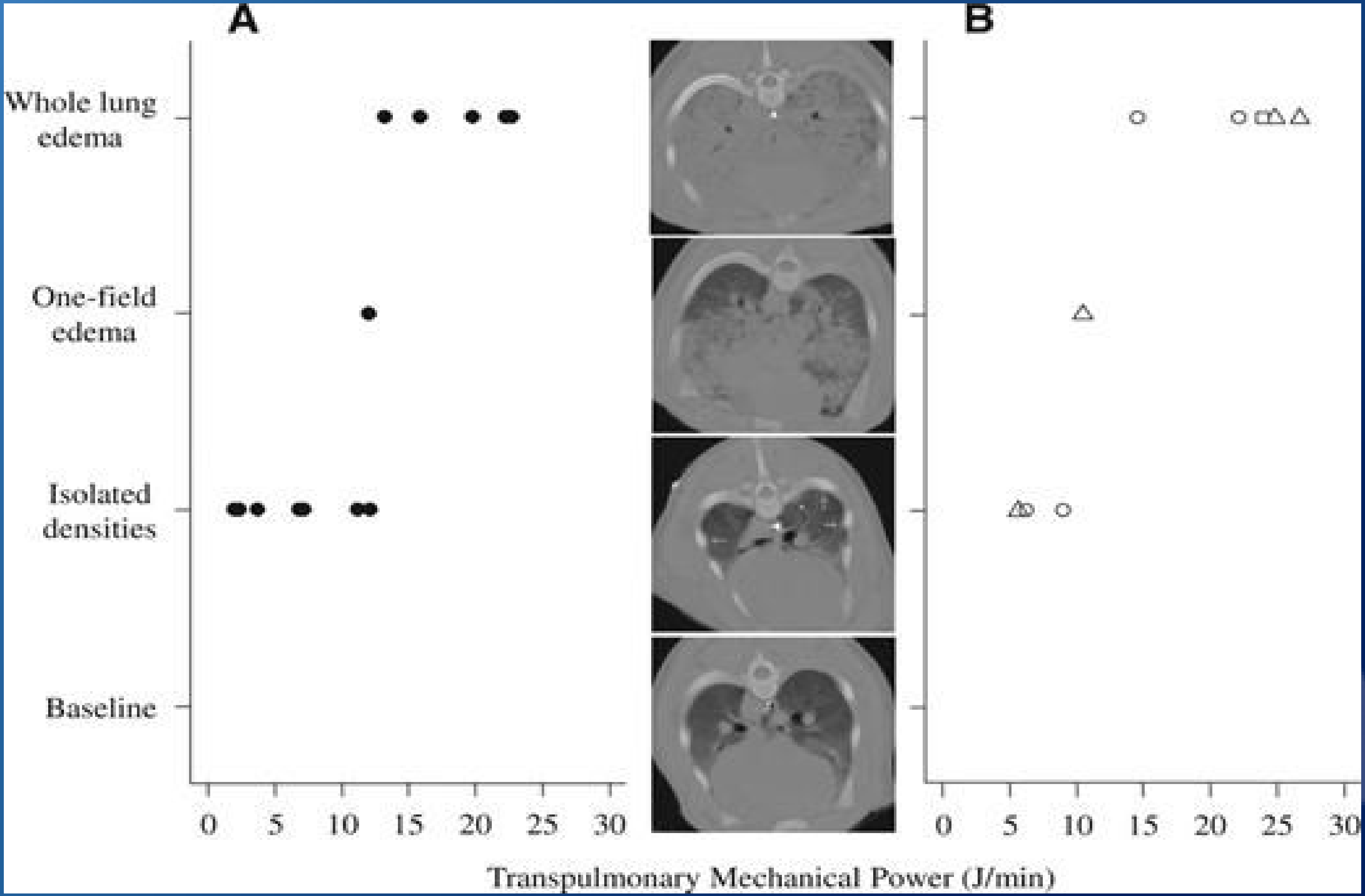
PCV vs AVM mode clinical trial

	PCV	AVM-2	% mean difference	P Value	95% CI
Mechanical Power (J/min)	21.62 ± 7.61	14.21 ± 6.41	41.39	< 0.001	–13.37, -5.11
Total work (J)	11.81 ± 3.81	8.11 ± 4.23	37.15	< 0.001	-2.04, -6.24
PEEP work (J)	4.83 ± 2.71	4.11 ± 2.51	16.1	< 0.001	-0.68, -3.02
Tidal work (J)	3.83 ± 1.51	2.21 ± 0.89	53.64	< 0.001	-1.09, -2.26
Resistive work (J)	3.23 ± 1.61	1.81 ± 1.31	56.35	0.013	-1.29, -3.36
Elastic work (J)	8.62 ± 3.13	6.32 ± 3.21	30.8	< 0.001	-2.63, -5.59
Inspiratory work (J)	6.95 ± 2.58	4.05 ± 2.01	52.73	< 0.001	-2.89, -4.72
Tidal volume (ml)	511 ± 8.22	413 ± 10.21	21.21	< 0.001	-49.6, -145.27
Tidal volume / IBW	7.38 ± 1.74	6.49 ± 1.72	12.83	0.004	-0.12, -2.26
Respiratory rate (Bpm)	19.61 ± 4.32	18.32 ± 1.43	6.78	0.176	-5.81, -1.19
Minute ventilation (L/min)	8.96 ± 1.34	7.42 ± 1.41	18.83	< 0.001	-1.28, 2.91
Driving pressure (cmH_2O)	24.45 ± 6.29	20.11 ± 6.59	19.47	0.012	-2.78, -7.76
Static Compliance (ml/cmH_2O)	20.24 ± 5.16	22.72 ± 6.79	11.55	0.346	2.89, 8.22
Power Compliance Index	1.11 ± 0.41	0.71 ± 0.33	43.96	< 0.001	-0.41, -0.71
$PaCO_2$ (mmHg)	44.94 ± 9.62	44.13 ± 10.11	1.82	0.825	-10.53, 4.41
PaO_2: FiO_2	243.54 ± 109.85	274.21±125.13	11.85	0.343	44.36, 157.19
PEEP (cmH_2O)	12.11± 5.02	12.11± 5.02	N/A	1.0	N/A

Mechanical Power and VILI



Mechanical Power and VILI



Cressoni M et al. Mechanical Power and Development of Ventilator-induced Lung Injury. Anesthesiology 2016; 124:1100–1108

Mechanical Power and mortality

Effect of mechanical power on mortality in invasively ventilated ICU patients without the acute respiratory distress syndrome
An analysis of three randomised clinical trials

Effect of mechanical power on intensive care mortality in ARDS patients

RESULTS

At day 28, 644 patients (33%) had died. Hazard ratios for mortality at day 28 were higher with an increasing MP, even when stratified for its individual components (driving pressure ($P < 0.001$), tidal volume ($P < 0.001$), respiratory rate ($P < 0.001$) and maximum airway pressure ($P = 0.001$). Similar associations of mechanical power (MP) were found with mortality at day 90, lengths of stay in ICU and hospital. Hazard ratios for mortality at day 28 were not significantly different if patients were stratified for MP, with increasing levels of each individual component.

CONCLUSION

In ICU patients receiving invasive ventilation for reasons other than ARDS, MP had an independent association with mortality. This finding suggests that MP holds an added predictive value over its individual components, making MP an attractive measure to monitor and possibly target in these patients.

Key Points

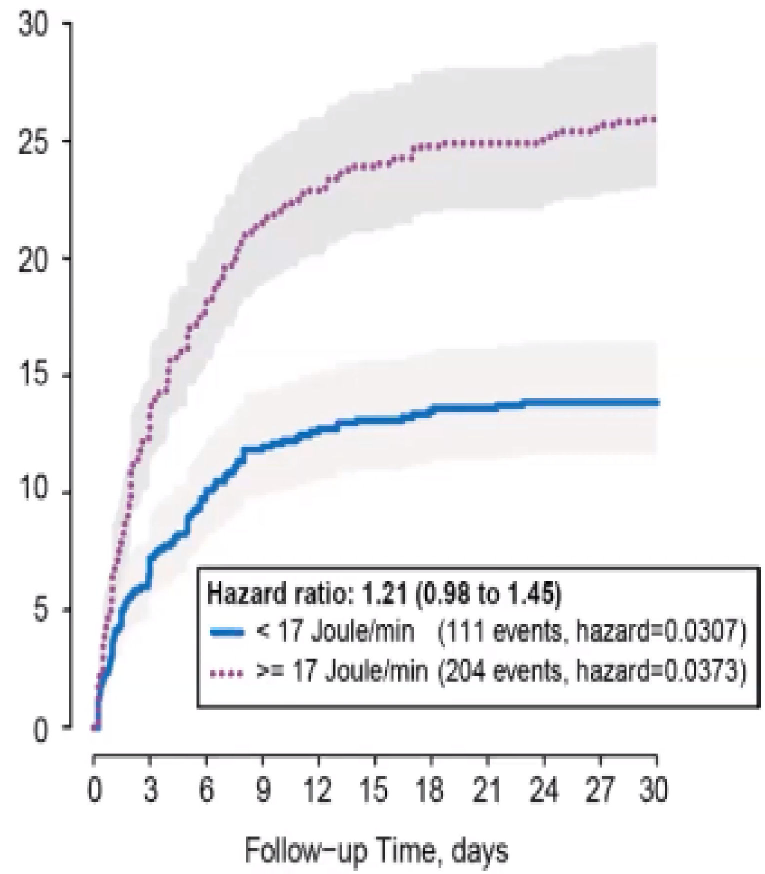
- ✓ Mechanical power and transpulmonary mechanical power did not influence the intensive care mortality
- ✓ Given the same PEEP, the two other components of mechanical power, respiratory system elastance and airway resistance, were not different in determining intensive care mortality
- ✓ Mechanical power when normalized to the well inflated tissue and compliance was independently associated to the intensive care mortality in patients with similar age, SAPS II and ARDS severity
- ✓ Transpulmonary mechanical power when normalized to well aerated tissue seems to better predict the outcome compared to the mechanical power normalized to respiratory system compliance.

van Meenen et al. Effect of mechanical power on mortality in invasively ventilated ICU patients without the acute respiratory distress syndrome: An analysis of three randomised clinical trials. European Journal of Anaesthesiology 40(1) 21-28, 2023.

Coppola S, et al. Effect of mechanical power on intensive care mortality in ARDS patients. Crit Care. 2020 May 24;24(1):246.

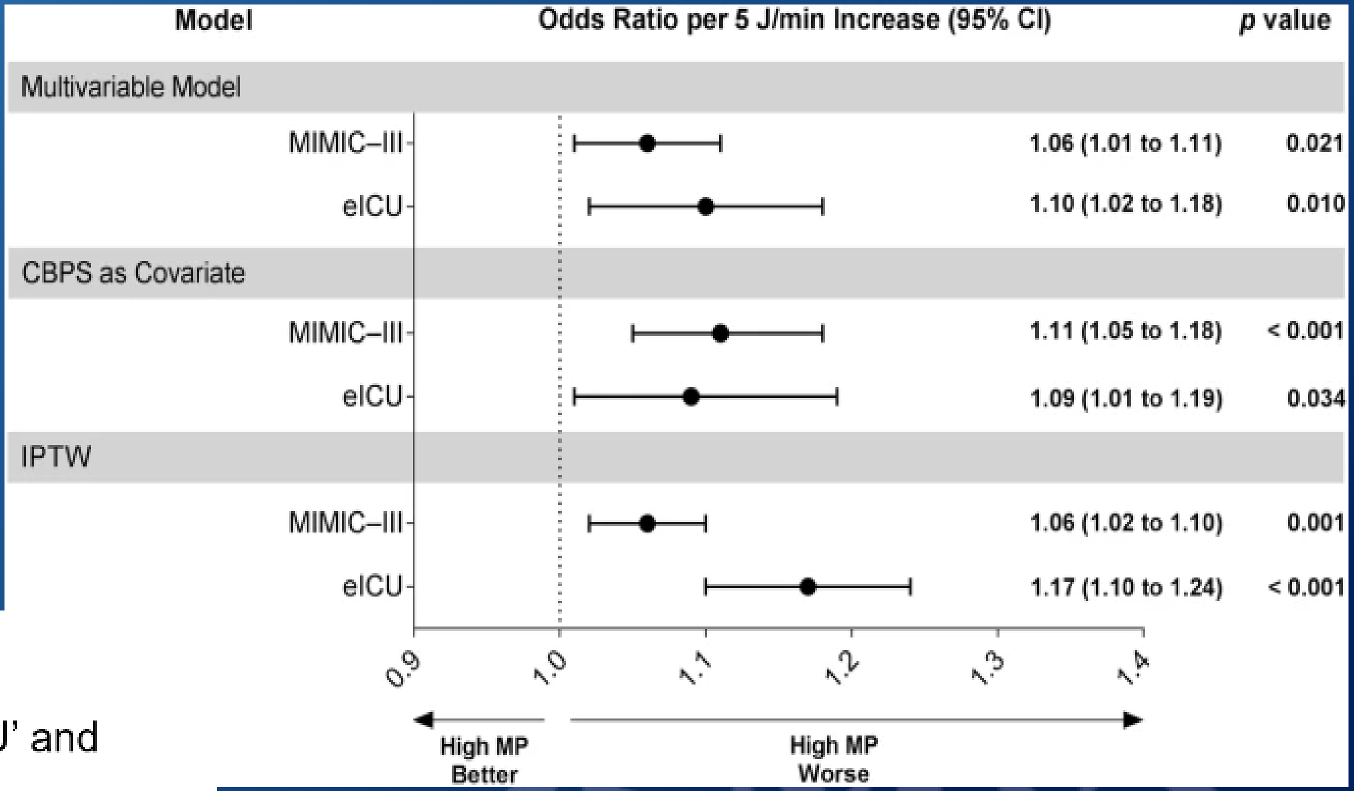
Mechanical Power and mortality

- prospective cohort study
- 1589 patients
- MP > 17 J/min: higher mortality



Urner M, et al. Time-varying intensity of mechanical ventilation and mortality in patients with acute respiratory failure: a registry-based, prospective cohort study. Lancet Respir Med. 2020 Sep;8(9):905-913.

Mechanical Power and mortality



8207 patients

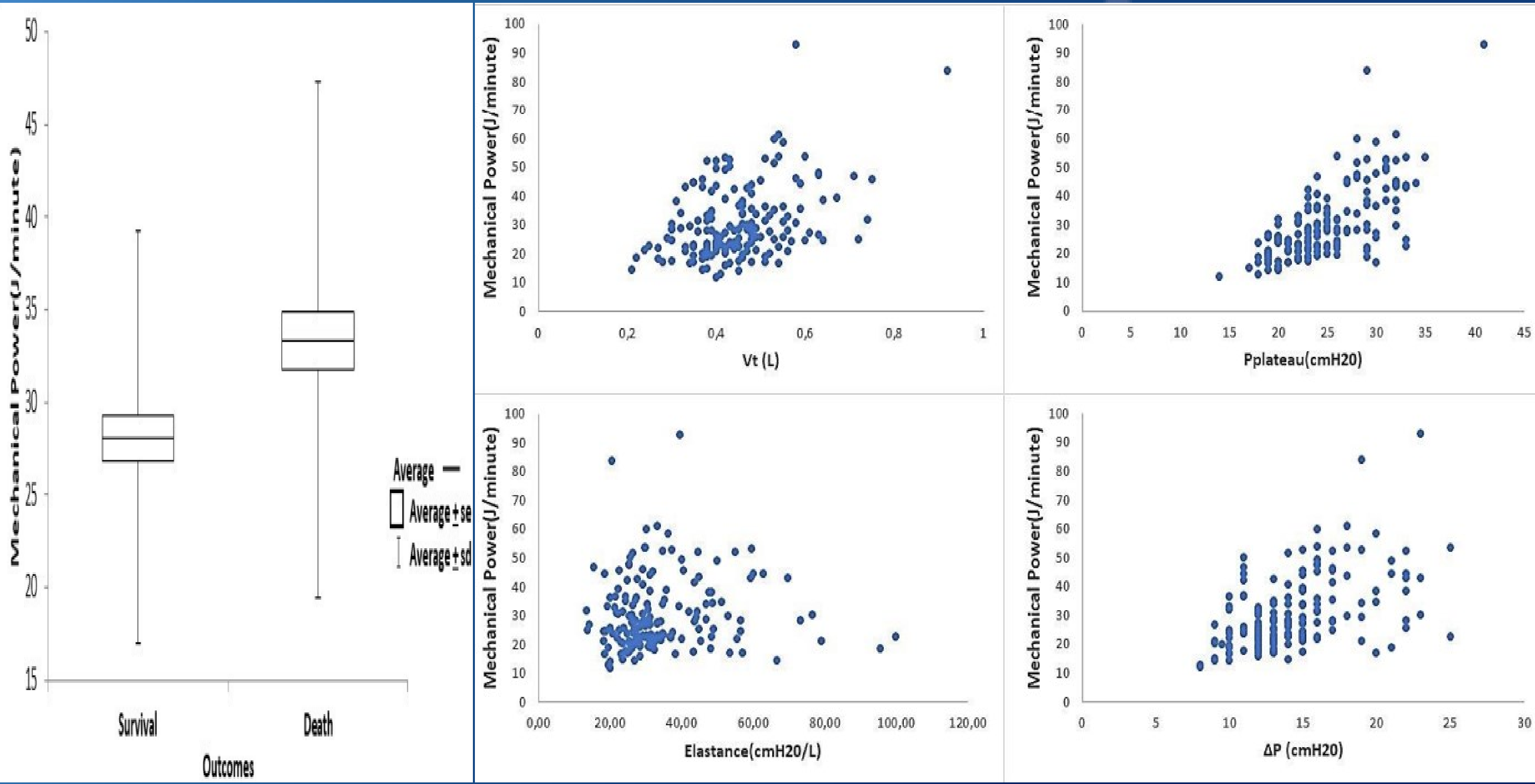
IPD meta-analysis of 'eICU' and 'MMIC-III'

higher MP is associated with worse outcomes

safety cutoff < 17 J/min

Serpa Neto A, et al PROVE Network Investigators. Mechanical power of ventilation is associated with mortality in critically ill patients: an analysis of patients in two observational cohorts. Intensive Care Med. 2018 Nov;44(11):1914-1922.

Mechanical Power and mortality COVID-19



Franck CL, et al. Correlations of mechanical power and its components with age and its interference in the outcome of SARS-CoV-2 in subjects undergoing pressure-controlled ventilation. J Mech Vent 2022; 3(4):159-168.

Partially Answered & Unanswered Questions

- MP and VILI ✓
- MP and mortality ✓
- Is the healthy or injured lung more vulnerable to MP ?
- Is Respiratory or Trans-Pulmonary MP better ✓ ?
- Indexing the MP (Compliance/Elastance, VT, Aeriated area) ✓
- Alveolar MP ?
- What component of the power is more important ?
- How about Auto-PEEP ?
- Should we target a certain number ✗
- What is the best way to measure MP ?
- Passive vs Active patient (Pmus) ?
- Automatic measurements ✓
- Closed-loop modes are better at reducing MP ✓

Key

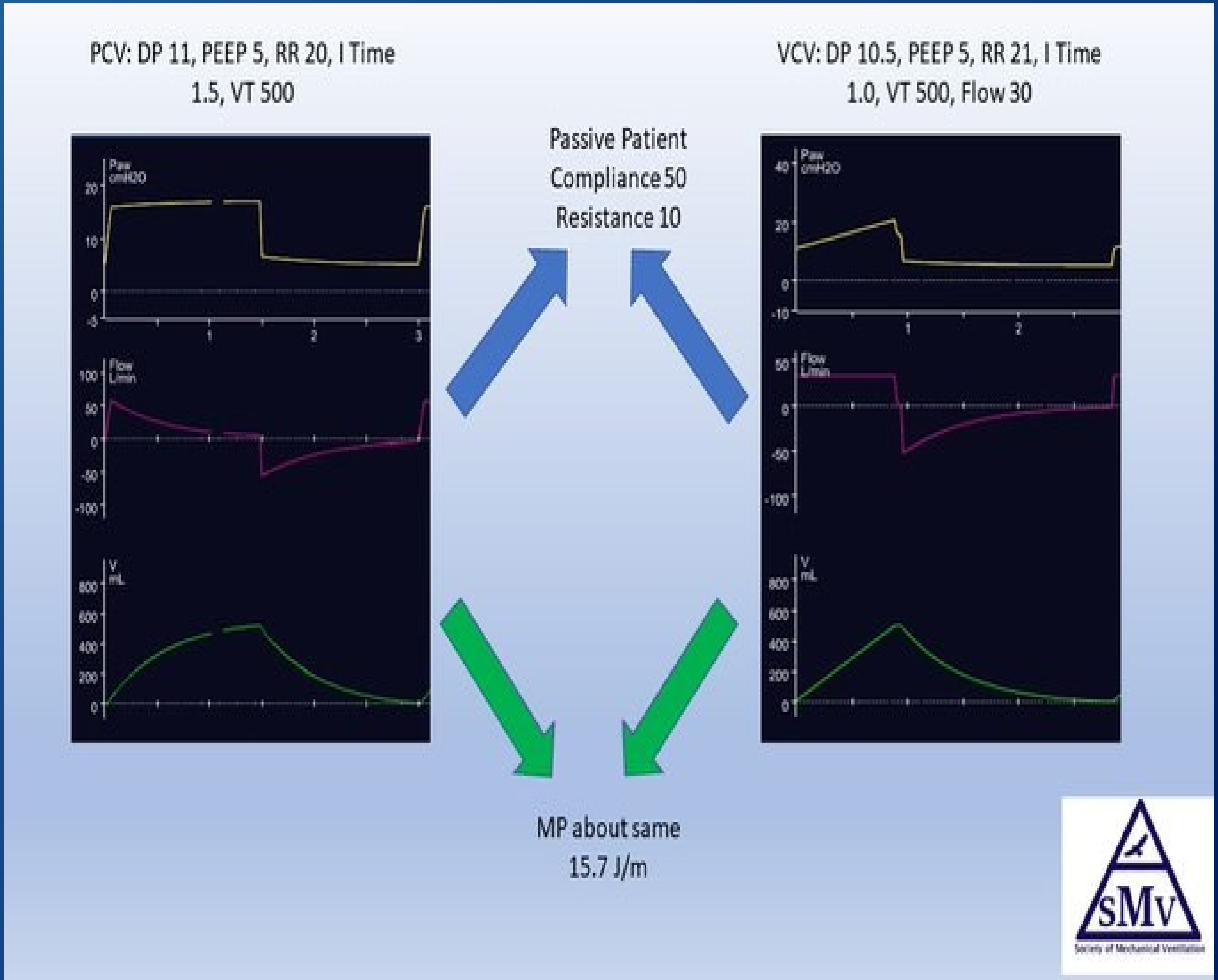
✓ Evidence for yes

? No Evidence yet

✗ No

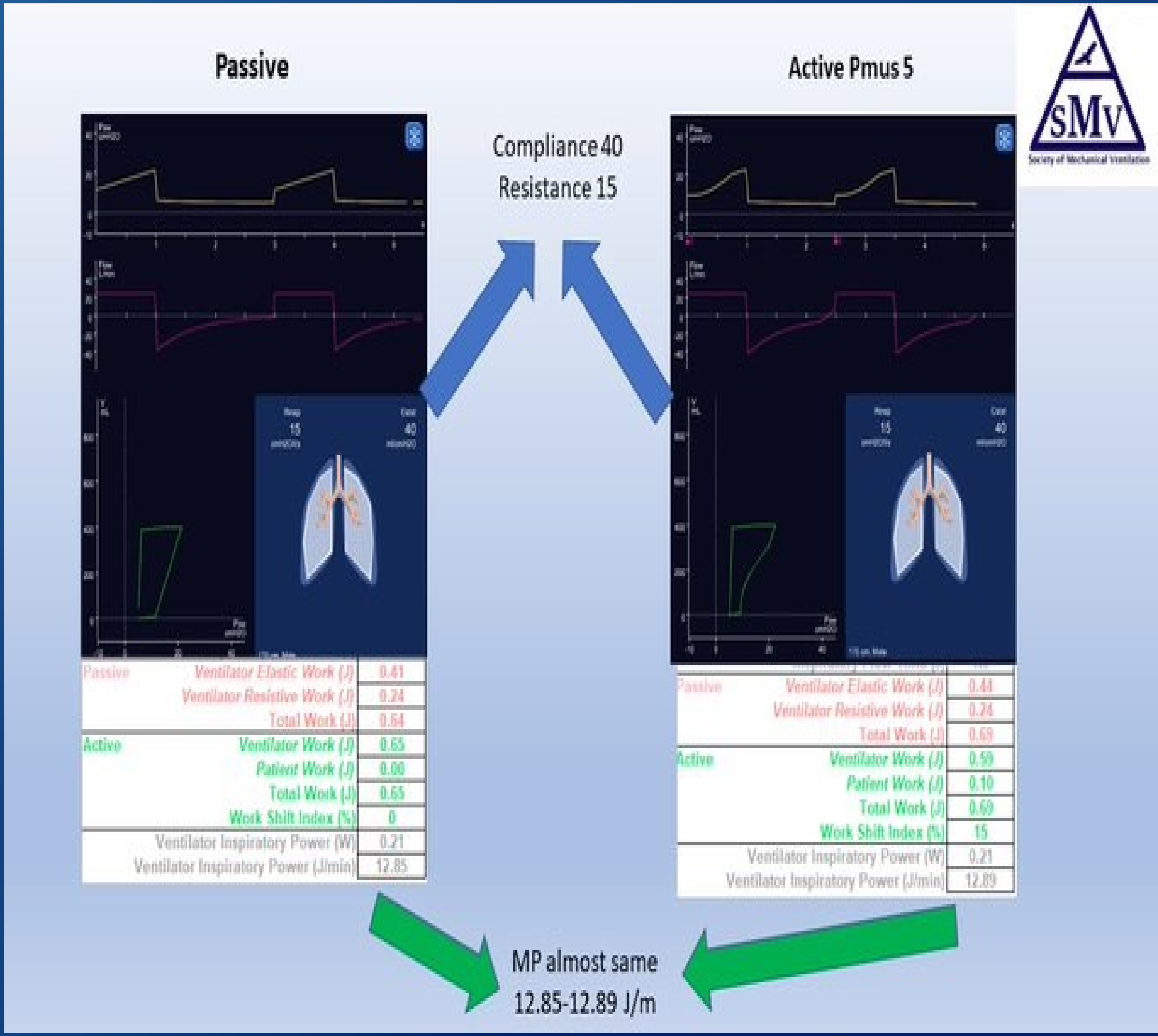
Mode

- MP the same here in VCV & PCV
- Are both the same, or is one superior to the other?



Patient

- MP is almost the same in Passive (Ventilator Power) and Active patients (Ventilator + Muscle Power).
- Are both the same, or is one superior to the other?



Pmus

PCV

Passive

Passive	Ventilator Elastic Work (J)	0.57
	Ventilator Resistive Work (J)	0.24
	Ventilator Total Work (J)	0.81
Active	Ventilator Work (J)	0.85
	Patient Work (J)	0.00
	Total Work (J)	0.85
	Work Shift Index (%)	0
	Ventilator Inspiratory Power (W)	0.24
	Ventilator Inspiratory Power (J/min)	14.43

Active

Passive	Ventilator Elastic Work (J)	0.57
	Ventilator Resistive Work (J)	0.24
	Ventilator Total Work (J)	0.81
Active	Ventilator Work (J)	1.10
	Patient Work (J)	0.18
	Total Work (J)	1.28
	Work Shift Index (%)	14
	Ventilator Inspiratory Power (W)	0.31
	Ventilator Inspiratory Power (J/min)	18.69

VCV

Passive

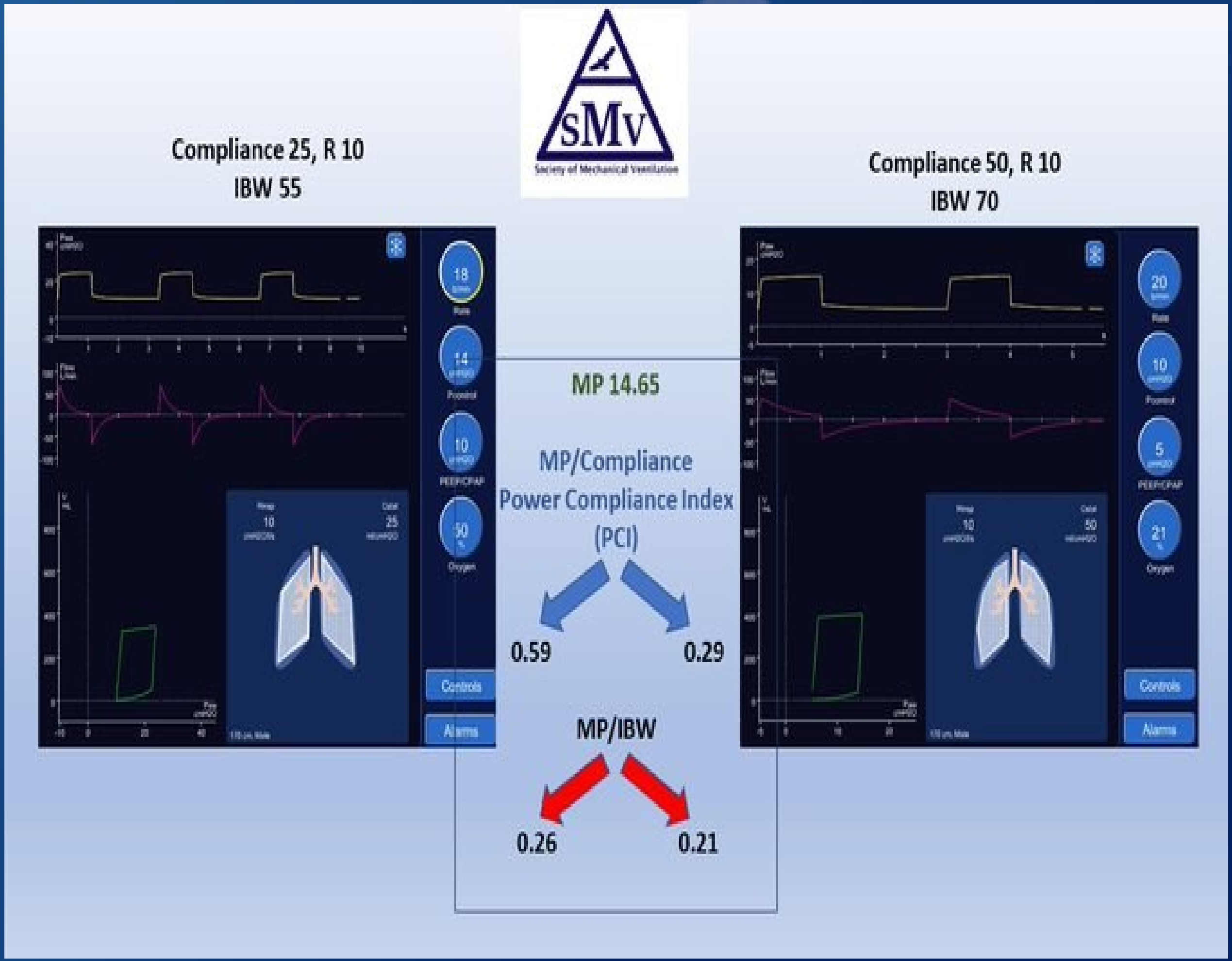
Passive	Ventilator Elastic Work (J)	0.59
	Ventilator Resistive Work (J)	0.20
	Total Work (J)	0.78
Active	Ventilator Work (J)	0.79
	Patient Work (J)	0.00
	Total Work (J)	0.79
	Work Shift Index (%)	0
	Ventilator Inspiratory Power (W)	0.20
	Ventilator Inspiratory Power (J/min)	11.77

Active

Passive	Ventilator Elastic Work (J)	0.59
	Ventilator Resistive Work (J)	0.20
	Total Work (J)	0.78
Active	Ventilator Work (J)	0.67
	Patient Work (J)	0.12
	Total Work (J)	0.79
	Work Shift Index (%)	16
	Ventilator Inspiratory Power (W)	0.17
	Ventilator Inspiratory Power (J/min)	10.05

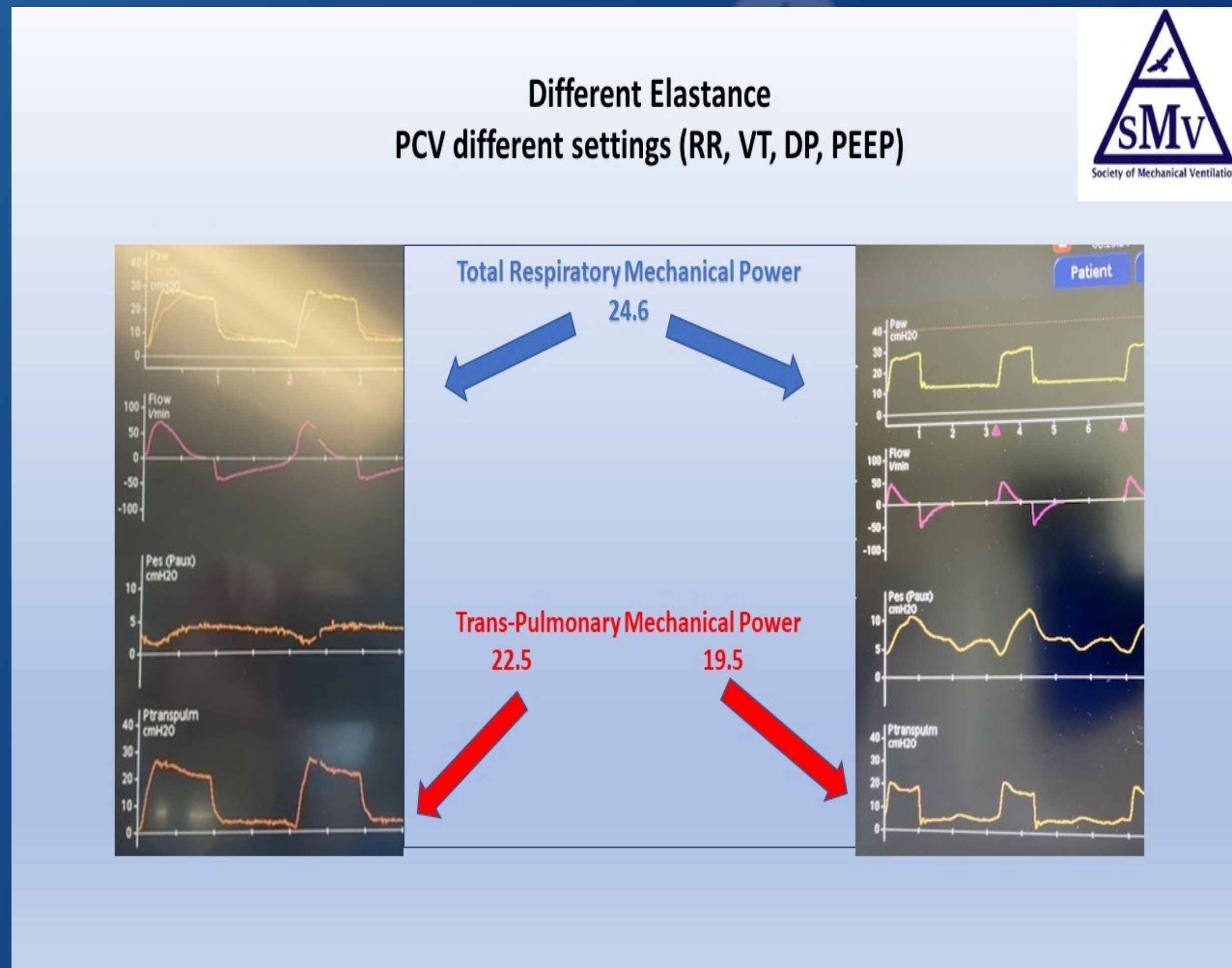
Index
Power Compliance Index

- MP is almost the same in different respiratory mechanics and IBW
- Are both at the same risk of injury?

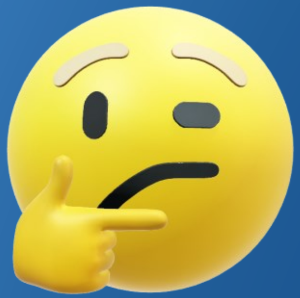


Trans-Pulmonary Mechanical Power

- Total MP is equal, but Trans-Pulm MP is higher in one of them
- Is it more prone to injury?



Great....So What To Do At The Bedside?



- Tolerate the lowest RR, VT, DP (*Permissive Hypercapnia*)
- Adequate PEEP (*That's a very long conversation*)
- Esophageal Balloon (*Calculate Trans-Pulmonary DP to exclude pressures to inflate chest wall*)
- Prone positioning might reduce the need for high DP
- Adequate sedation to reduce large pleural pressure swings (*High transpulmonary pressures and Asynchronies*)