

Intracranial response to positive end-expiratory pressure is influenced by lung recruitability and gas distribution during mechanical ventilation in acute brain injury patients: a proof-of-concept physiological study

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Supplementary material

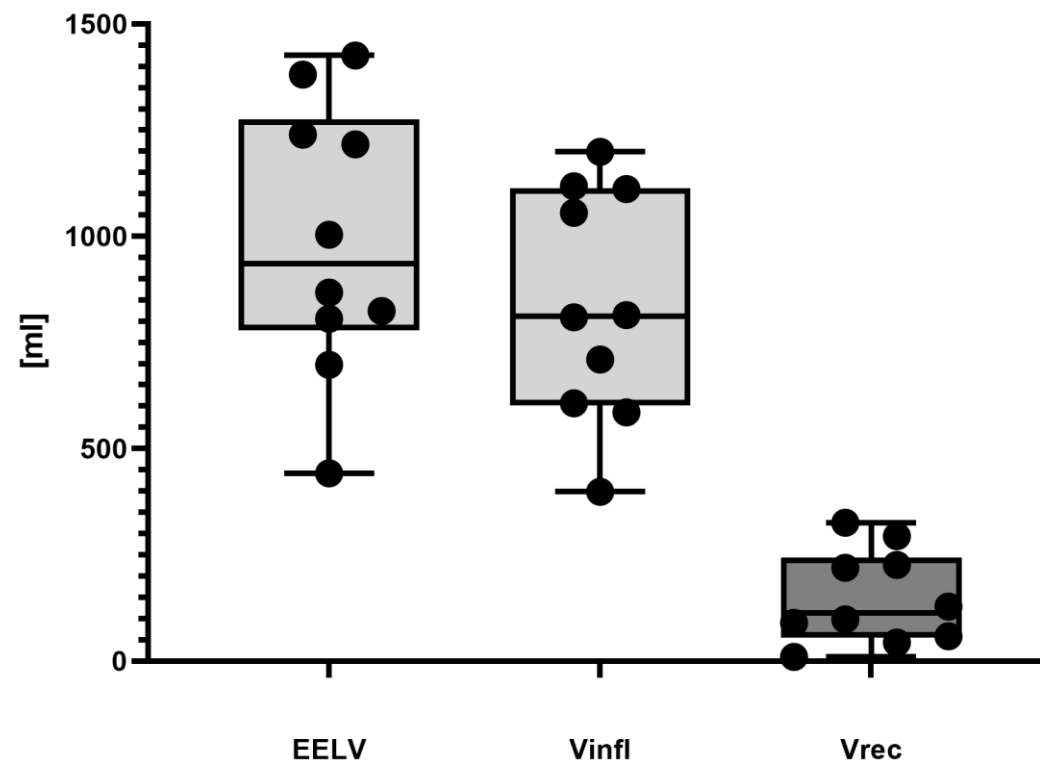
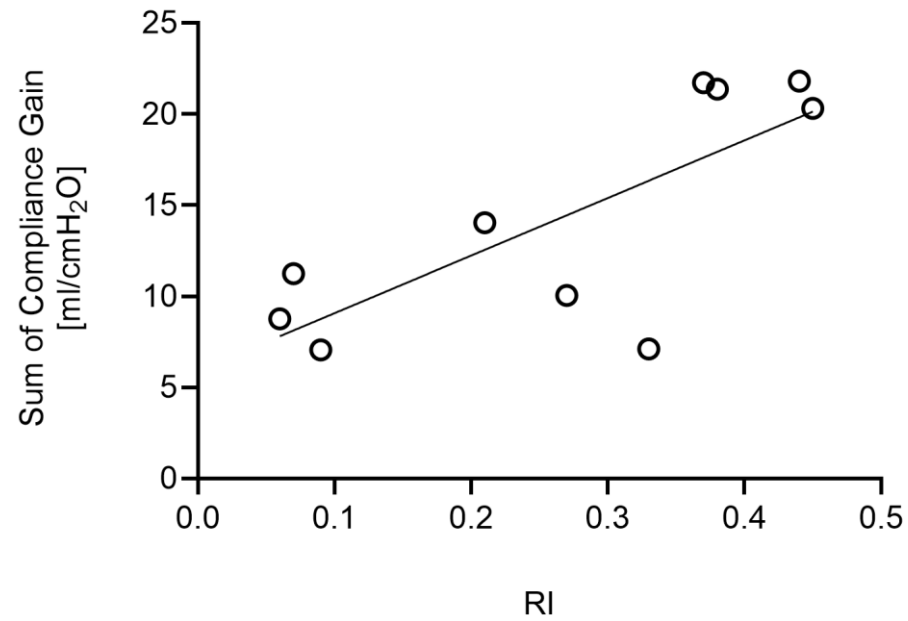
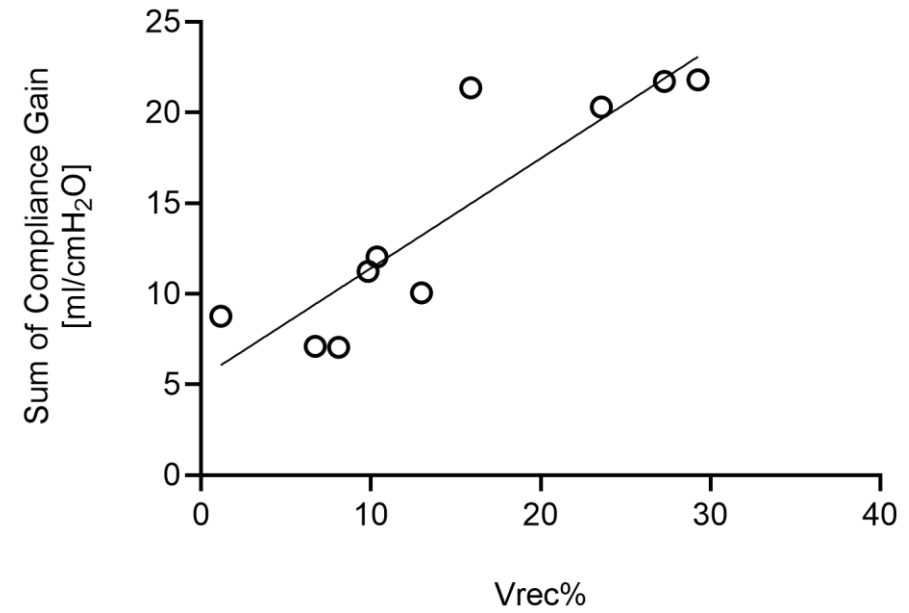


Figure E1. Spirometric delta end-expiratory lung volume (Δ EELV), inflated volume (Vinfl) and recruited volume (Vrec). Δ EELV, Vinfl, and Vrec calculated the recruitment-to-inflation ratio based on the single-breath de-recruitment manoeuvre from high to low PEEP.



rho= 0.68
R²= 0.57
p= 0.01



rho= 0.90
R²= 0.79
p< 0.01

Figure E2. Linear regression and Spearman's correlation investigating the relationship between the sum of Compliance Gain [ml/cmH₂O] and a) RI ratio or b) Vrec%. A sensitivity analysis to investigate the relationship between the indicators of recruitment reported in the study (spirometric RI ratio and Vrec%) and the regional gain in compliance. RI ratio: recruitment-to-inflation ratio; Vrec%: recruited volume expressed as a percentage of the corresponding Δ EELV.

Patient number	FIO ₂	PaO ₂ Baseline	PaO ₂ HIGH PEEP	PaO ₂ LOW PEEP	PaO ₂ /FIO ₂ Baseline	PaO ₂ /FIO ₂ HIGH PEEP	PaO ₂ /FIO ₂ LOW PEEP	ΔPaO ₂ /FIO ₂ (LOW PEEP - HIGH PEEP)	RI
1	0.30	113	113		375	378			0.07
2	0.30	139	139		463	463			0.38
3	0.30	129	124		430	413			0.33
4	0.30	100	107	89	333	355	298	-58	0.27
5	0.55	98	124	105	179	225	191	-35	0.45
6	0.50	101	100	113	203	200	225	25	0.06
7	0.35	109	95	91	311	272	259	-13	0.21
8	0.30	105	110	95	350	365	315	-50	0.44
9	0.60	99	100	79	165	167	131	-35	0.37
10	0.30	142	136	145	473	453	483	30	0.09

Table E1. Individual FIO₂, PaO₂, PaO₂/FIO₂ and spirometrical RI ratio values. Three out of ten patients had missing values for PaO₂ at low PEEP. FIO₂: fraction of inspiratory oxygen; PaO₂: arterial partial pressure of oxygen; RI: recruitment-to-inflation ratio; rho = Spearman correlation coefficient; R²: coefficient of determination; p = p-value or probability value.

Neuromonitoring variables	Baseline		PEEP high		PEEP low		Friedman's test p-value	Baseline vs High PEEP p-value	Baseline vs Low PEEP p-value	High PEEP vs Low PEEP p-value
	median	IQR	median	IQR	median	IQR				
CPP [mmHg]	79	[70 - 84]	71	[67 - 83]	75	[70 - 84]	0.03 *	0.29	1	0.03 *
ICP [mmHg]	7	[4 - 10]	9	[5 - 13]	12	[8 - 16]	< 0.01 *	0.53	< 0.01 *	0.02 *
P2 [mmHg]	12	[10 -14]	12	[10 -15]	15	[12 - 21]	< 0.01 *	0.79	< 0.01 *	0.04 *

Table E2. Friedman's test followed by Bonferroni's correction for comparisons among neuromonitoring variables. 1) baseline ventilation, 2) PEEP high, and 3) PEEP low. Data reported as median [interquartile range]. Abbreviations: CPP: cerebral perfusion pressure; ICP: intracranial pressure; P2, ICP: second peak of intracranial pressure; IQR: interquartile range. *: to mark significant differences.

RI associated variables	mean	[± STD]
Regional (pixelwise)		
ΔEELV [ml]	3.7	[± 1.3]
Inflating Volume [ml]	3.1	[± 1]
Recruiting Volume [ml]	0.7	[± 0.5]
Recruiting Volume [% of ΔEELV]	16	[± 10]

Table E3. Inflated and Recruited volumes. Delta end-expiratory lung volume (ΔEELV), inflated volume (Vinfl) and recruited volume (Vrec) were computed at a pixel level. Data reported as mean [± STD]. Abbreviations: RI: recruitment inflation ratio; ΔEELV: delta of end-expiratory lung volume between the two tested PEEP levels; GI: global inhomogeneity index; LI: local inhomogeneity index; STD: standard deviation.