

Figure S1 Calculation illustration of the pressure generated by global inspiratory muscles (ΔP_{mus}), the inspiratory pressure-time product ($PTP_{pes,insp}$), and the electrical activity of diaphragm (ΔE_{Adi}). The recoil pressure of the chest wall (dotted black curve line) is calculated from the predicted elastance of chest wall (4% vital capacity) and the lung volume. The recoil pressure starts from the onset of the P_{es} dropping. The broken vertical red line indicates the onset of the decrease in P_{es} . The following three solid lines indicate the start and end of the inspiration and expiration of one breathing circle. The $\Delta P_{mus,insp}$ is the difference between the nadir of the P_{es} tracing and the chest recoil pressure at the same time (blue arrow). The intrinsic positive end expiratory pressure ($PEEP_i$) is the part between the onset of P_{es} dropping and the start of the inspiratory flow. The $PTP_{pes,insp}$ is calculated as the area between the chest wall recoil pressure and the esophageal pressure (gray area). The amplitude of electrical activity of the diaphragm (ΔE_{Adi}) is the difference between the onset of E_{Adi} rising and the peak of the E_{Adi} (blue arrow).

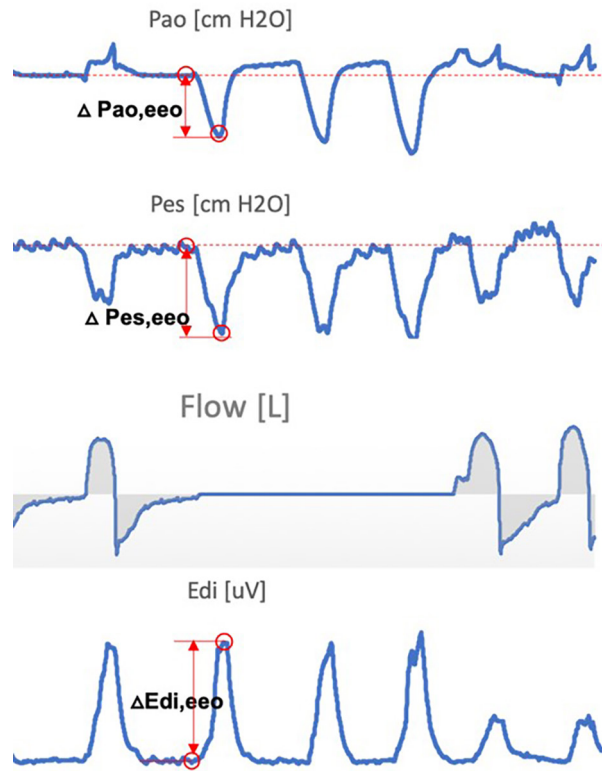


Figure S2 Calculation illustration of the neuro-mechanical efficiency during the end-expiratory occlusion (NMEoccl). From top to bottom are the airway pressure (Pao), esophageal pressure (Pes), flow, and electrical activity of diaphragm (EAdi) tracing. The end-expiratory occlusion includes three breathing efforts. The calculation is performed with the first breath, both the Pes and Pao could be used to calculate the NMEoccl. Amplitude of inspiratory Pes ($\Delta P_{es,eeo}$) and EAdi ($\Delta E_{di,eeo}$) are same as described in the Fig. S1. The NMEoccl is defined as the $\Delta P_{ao,eeo}$ divided by the $\Delta E_{di,eeo}$.

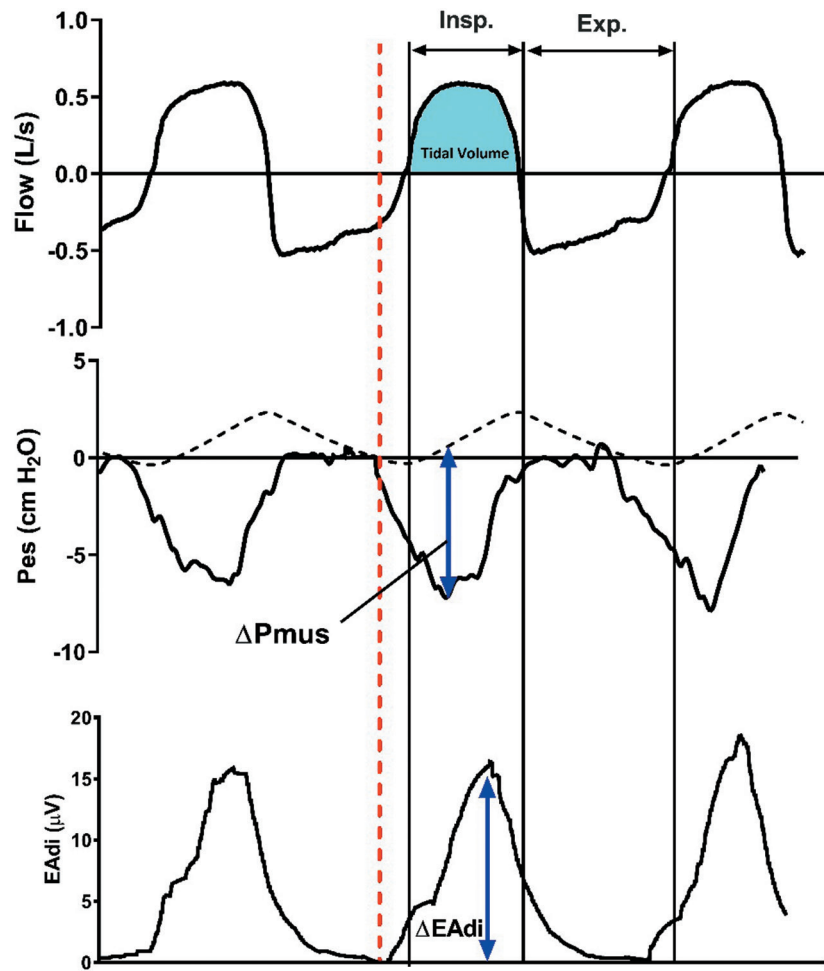


Figure S3 Calculation illustration of the dynamic neuro-mechanical efficiency (NME_{dyn}) and neuro-ventilatory efficiency (NVE) during tidal breathing. Inspiratory tidal volume (V_t) is integrated from flow signal during the inspiration. The ΔEA_{di} and ΔP_{mus} calculated as mentioned in Fig. S1. The NME_{dyn} is the ratio of ΔP_{mus} divided by the ΔEA_{di} . The NVE is the ratio of tidal volume divided by the ΔEA_{di} .

Table S1 Protocolized criteria for failed spontaneous breathing trial

Tachypnea: respiratory rate >35 breaths/min for ≥ 5 min

Hypoxemia: pulse oximeter <90% despite increasing F_{iO_2} to 0.5 for ≥ 30 s

Heart rate: >140 beats/min or a 20% change from baseline for ≥ 1 min

Hypertension or hypotension: systolic blood pressure >180 or <90 mmHg for ≥ 1 min

Agitation, diaphoresis, or anxiety confirmed as a change from baseline and present for >5 min

Table S2 Screening checklist used to determine the patient's suitability for extubation

Question	Answer
1. Awake and alert with cerebral function adequate for patient co-operation or equivalent pre SBT state of consciousness?	Yes <input type="checkbox"/> No <input type="checkbox"/>
2. Haemodynamic stability (lack of vasopressor support and mean arterial pressure within 10–15% of baseline)?	Yes <input type="checkbox"/> No <input type="checkbox"/>
3. Adequate recovery of muscle strength?	Yes <input type="checkbox"/> No <input type="checkbox"/>
4. Normal tidal volumes, normocapnia (end-tidal carbon dioxide 30–45 mm Hg), minimum pulse oximetry >95% with F_{iO_2} 0.5?	Yes <input type="checkbox"/> No <input type="checkbox"/>
5. Intact gag reflex and swallow function (presence of clearly audible cough during suctioning)?	Yes <input type="checkbox"/> No <input type="checkbox"/>

The answer to all questions must be “yes” in order for extubation to be approved.

Table S3 Characteristics of subjects in the ventilator failed liberation (A) and successful ventilator liberation (B) groups.

A Subjects failed ventilator liberation (Defined as reconnection to the ventilator or reintubation within 48 hours)						
Patients No.	Age (yr)	Sex (M/F)	Location of lesion	MV indications	Failed extubation or separation (hours)	Reasons for reconnection to MV
1	52	Male	Supratentorial, frontal lobe (right)	Intracerebral hemorrhage, Stroke	12.3	Neurological deterioration
3	52	Male	Infratentorial, petroclival region (left)	Neurogenic pulmonary edema	0.2	Upper airway obstruction after extubation
4	61	Male	Infratentorial, ventral medulla (right)	Respiratory center involvement	0.5	Upper airway obstruction after extubation
5	51	Male	Supratentorial, middle cranial fossa	Coma	29.9	Severe pneumonia
6	55	Male	Infratentorial, cerebellopontine angle (left)	Pulmonary embolism	3.1	Upper airway obstruction after extubation
12	32	Male	Supratentorial, temporal lobe, basal segment region (right)	Intracerebral hemorrhage, Stroke	4.4	Neurological deterioration
13	53	Female	Infratentorial, cerebellum (bilateral)	Post cardiac arrest hypoxic ischemic brain injury	20.2	Pulmonary edema
14	61	Female	Infratentorial, petroclival region (right)	Lung atelectasis	14.0	Severe pneumonia
17	39	Male	Supratentorial, temporal lobe (right)	Cerebral herniation	11.8	Neurological deterioration
18	50	Female	Infratentorial, hypothalamus (right)	Coma	0.9	Neurological deterioration
21	67	Male	Supratentorial, occipital lobe (right)	Cerebral infarction	37.3	Neurological deterioration
25	55	Male	Supratentorial, middle cranial fossa	Acute respiratory distress syndrome	4.8	Severe pneumonia
31	39	Female	Infratentorial, jugular foramen region (right)	Respiratory center involvement	39	Upper airway obstruction after extubation
49	52	Male	Infratentorial, ventral medulla (left)	Respiratory center involvement	1.3	Neurological deterioration
59	33	Male	Infratentorial, ventral medulla (left)	Respiratory center involvement	5.0	Respiratory muscle weakness
64	30	Male	Infratentorial, cerebellum (right)	Respiratory center involvement	4.0	Neurological deterioration
65	30	Male	Supratentorial, frontal, temporal lobe (right)	Intracerebral hemorrhage, Stroke	1.0	Neurological deterioration
B Subjects with successful ventilator liberation (Defined as remained liberated from the ventilator 48 hours after the SBT).						
Patient No.	Age (yr)	Sex (M/F)	Location of lesion	MV indications	Time between end of the SBT and the reconnection to MV (hours)	Reasons for reconnection to MV
2	69	Male	Infratentorial, ventral medulla	Neurogenic pulmonary edema	99.9	Hospital acquired pneumonia (Aspiration)
7	72	Male	Infratentorial, dorsal medulla	Respiratory center involvement	192.9	Hospital acquired pneumonia (Aspiration)
8	68	Male	Carotid artery (right)	Cerebral infarction	109.5	Neurologic deterioration
9	65	Male	Middle cerebral artery (right)	Acute respiratory distress syndrome	---	---
10	52	Male	Middle meningeal artery (right)	Coma	---	---
15	37	Male	Supratentorial, frontal, temporal lobe (left)	Lung atelectasis	---	---
16	38	Male	Supratentorial, basal ganglia (left)	Aspiration pneumonia	74.5	Hospital acquired pneumonia (Aspiration)
19	59	Female	Supratentorial, hypothalamus (right)	Hypothalamic dysfunction	---	---
20	73	Female	Supratentorial, parietal, temporal lobe (left)	Postoperative epilepsy	---	---
22	53	Male	Infratentorial, cerebellum (left)	Neurogenic pulmonary edema	53.0	Post-extubation respiratory failure
24	52	Male	Infratentorial, cerebellum (left)	Pneumonia	---	---
26	61	Female	Infratentorial, cerebellopontine angle (right)	Sepsis (central nervous system)	588.2	Septic shock (Catheter-related bloodstream infection)
27	33	Female	Infratentorial, cerebellum	Acute respiratory distress syndrome	75.2	Lung atelectasis
29	59	Male	Infratentorial, midbrain, pons	Respiratory center involvement	---	---
30	36	Male	Infratentorial, ventral medulla	Lung atelectasis	---	---
32	56	Male	Supratentorial, middle cranial fossa	Pulmonary embolism	---	---
33	44	Female	Infratentorial, ventral medulla	Neurogenic pulmonary edema	53.3	Septic shock (Catheter-related bloodstream infection)
34	51	Male	Supratentorial frontal lobe (right)	Non neurological upper airway occlusion	168.0	Hospital acquired pneumonia
41	22	Male	Infratentorial, cerebellopontine angle (right)	Respiratory center involvement	58.5	Septic shock (Catheter-related bloodstream infection)
43	64	Male	Supratentorial, ventricular (right)	Postoperative epilepsy	---	---
45	33	Female	Supratentorial, ventricular (right)	Hydrocephalus, Intracranial hypertension	---	---
46	68	Female	Supratentorial, frontal lobe (left)	Intracranial hypertension	---	---
50	46	Female	Infratentorial, petroclival region (left)	Acute respiratory distress syndrome	---	---
52	50	Male	Infratentorial, ventral medulla (left)	Pneumonia	---	---
54	66	Female	Infratentorial, cerebellopontine angle (left)	Respiratory center involvement	58.0	Neurologic deterioration
55	53	Male	Infratentorial, ventral medulla (left)	Respiratory center involvement	---	---
57	72	Female	Infratentorial, cerebellum (right)	Acute respiratory distress syndrome	93.0	Hospital acquired pneumonia
60	57	Male	Supratentorial, temporal lobe (right)	Pulmonary embolism	---	---
63	67	Female	Carotid artery (right)	Intracranial hypertension	72.0	Neurologic deterioration

Table S4 Respiratory parameters during the SBT in successful (S) and failed (F) ventilator liberation groups within 48 hours after the SBT

Variables		Baseline	1MIN	5MIN	10MIN	20MIN	30MIN	P Value		
								Main Effects	Interaction	Interaction
								Time	Group	Time*Group
Tidal Volume (ml)	S	474.5 (352.2, 597.1)	403.0 (278.8, 524.3)‡	437.4 (336.3, 541.9) †	438.7 (321.0, 538.6)	388 (340.1, 537.4)	446.8 (341.9, 533.3) †	.035	.42	.73
	F	450.9 (395.9, 724.7)	390.1 (318.8, 561.3)†	415.6 (335.0, 600.7)	449 (336.9, 602.9)	397.9 (348.9, 613.5)	397.2 (340.1, 616.6)			
Respiratory rate (Breath/min)	S	19.1 (15.8, 22.2)	21.4 (16.8, 25.6)‡	20.8 (16.9, 25.6)	22.5 (14.3, 24.7)	21.0 (15.6, 25)	21.7 (16.7, 25.8)	.055	.69	.97
	F	19.1 (14.4, 25.9)	22.1 (17, 27.9)†	20.5 (16.5, 28.9)	20.3 (17.3, 28.6)	20.8 (16.3, 29)	20.4 (17.9, 28.1)			
Minute ventilation (L)	S	9 (7.7, 10.4)	7.8 (6.4, 10.0)†	8.6 (7.0, 9.8)	8.3 (7.1, 9.7)	8.4 (7.6, 10.1)	8.4 (7.8, 10.0) †	.051	.17	.81
	F	10.5 (6.7, 12.2)	9.9 (6.9, 10.9)	9.7 (7.7, 10.7)	9.0 (7.6, 11.3)	9.1 (7.3, 11.4)	9.5 (7.6, 11.3)			
Inspiratory time (sec)	S	1.1 (0.9, 1.3)	1.1 (0.9, 1.2)	1.1 (0.9, 1.3)	1 (0.9, 1.3)	1 (1, 1.2)	1.1 (0.9, 1.2)	.024	.47	.92
	F	0.9 (0.9, 1.2)	1 (0.9, 1.2)	1 (0.8, 1.3)	1 (0.9, 1.3)	0.9 (0.9, 1.2)	1 (0.9, 1.2)			
Expiratory time (sec)	S	2.1 (1.8, 2.6)	1.8 (1.5, 2.3)‡	1.9 (1.6, 2.3)	1.8 (1.5, 2.5)	1.8 (1.6, 2.5)	1.9 (1.4, 2.4)	.002	.87	.81
	F	2.1 (1.4, 2.9)	1.8 (1.3, 2.4)	1.8 (1.2, 2.5)	2 (1.2, 2.3)	1.8 (1.2, 2.5)	1.8 (1.2, 2.3)			
Duty cycle (%)	S	32.7 (31.1, 39.2)	36.8 (34.3, 40.0)‡	36.9 (33.9, 38.5)	37.1 (33.2, 40.7)	36.6 (34.2, 39.6)	37.8 (32.7, 41.3)	.27	.79	.97
	F	33.7 (29.0, 39.4)	37.9 (31.9, 40.6)†	36.1 (31.1, 40.3)	36.7 (30.4, 41.6)	36 (31.1, 41.8)	36.2 (32.2, 42.1)			
RR/VT (Breath•min ⁻¹ •L ⁻¹)	S	41.5 (25.8, 60.9)	52.9 (30.5, 87.8)‡	46.1 (30.4, 78.5) †	43.3 (25.6, 83.5) †	52.5 (29.2, 75.2)	48 (32.2, 74.9)	.026	.39	.76
	F	38.6 (17.6, 54.5)	51.2 (26.7, 78.1)†	52.3 (24.5, 70.0)	49.7 (25.7, 66.1)	48.4 (27.9, 71.5)	47.7 (28.8, 69.1)			
PEEPi (cmH ₂ O)	S	1.0 (0.4, 1.6)	1.3 (0.6, 2)	1.0 (0.5, 2.1)	1.1 (0.5, 1.6)	0.9 (0.4, 1.8)	1.0 (0.3, 1.3)	.06	.42	.97
	F	1.0 (0.1, 1.6)	1.2 (0.5, 2)	1.1 (0.5, 1.5)	0.7 (0.3, 1.7)	0.8 (0.5, 1.2)	0.6 (0.1, 1.4)			
PTP per breath (cmH ₂ O•sec)	S	4.1 (1.7, 6.4)	7.1 (4.2, 8.5)‡	7 (5.6, 9.3)	8.1 (5.9, 10.0)	7.3 (5.6, 9.7)	8.1 (5.7, 10)	.76	.34	.58
	F	4.7 (2.4, 7.4)	7.5 (5, 10.8)‡	8.4 (6.2, 11.6)	8.2 (5.6, 12.4)	8.5 (5.4, 11.6)	7.4 (5.7, 10.7)			
PTP per liter (cmH ₂ O•sec•L ⁻¹)	S	7.4 (4.5, 11.2)	17.1 (11.9, 22.4)‡	17.0 (12.9, 21.3)	18.2 (13.4, 22.6)	18.0 (13.6, 22.7)	18.0 (14.9, 22.6)	.70	.94	.83
	F	7.4 (6.1, 10.3)	16.7 (13.2, 23.7)‡	18.2 (12.3, 22.7)	18.2 (15.8, 22.4)	17.7 (15.2, 21)	17.7 (15.8, 19.9)			
NVE (ml/μV)	S	208.6 (119.5, 324.2)	67.9 (37.4, 125.3)‡	64.9 (44.0, 110.2)	63.2 (45.1, 115.8)	72.2 (41.4, 105.4)	66.1 (36.9, 115.2)	.58	.89	.58
	F	101.9 (64.0, 294.2)	53.0 (39.1, 191.3)	57.5 (29.5, 116.3)	55.1 (33.5, 138.9)	54.7 (30.1, 149.8)	50.1 (38.1, 97.9)			
NMEdyn (cmH ₂ O/ μV)	S	1.5 (0.8, 2.0)	1.2 (0.8, 1.8)	1.2 (0.9, 1.7)	1.2 (0.9, 2.5)	1.2 (1, 2.4)	1.1 (0.9, 1.8)	.24	.12	.81
	F	1.5 (0.8, 3.7)	1.5 (1.1, 4.2)	1.2 (1.0, 4.0)	1.5 (1.0, 3.6)	1.2 (1.0, 4.2)	1.7 (1.0, 3.0)			
ΔPmus (cmH ₂ O)	S	6.0 (1.8, 7.8)	8.7 (6.2, 11.5)‡	10.0 (8.3, 12.2)	11.3 (8.1, 13.2)	10.8 (8.0, 12.9) †	11.2 (8.4, 13.3) †	.003	.11	.78
	F	7.9 (3.6, 10.1)	10.3 (8.1, 16.5)‡	11 (8.8, 16.1)	13.4 (8.9, 15.6)	12.5 (8.6, 18.5)	11.7 (8.7, 18.1)			
PTP per min (cmH ₂ O•min)	S	60.4 (38.9, 112.5)	142.3 (96.7, 187.7)‡	150.2 (103.5, 180)	142.3 (111.7, 197.7)	167.1 (113.9, 194.4)	162.7 (124.5, 195.7)	.60	.22	.58
	F	95.6 (36.1, 154.9)	176.0 (121.2, 239.9)‡	175.1 (121.5, 227.4)	167.5 (130.5, 221.2)	164.3 (136.0, 238.7)	167.8 (125.1, 213.9)			
ΔEAdi (μV)	S	2.4 (1.3, 4.4)	5.8 (3.4, 10.3)‡	6.5 (3.8, 9.9)	6.3 (3.7, 10.9)	5.8 (3.7, 9.7)	6.8 (3.5, 12.3)	.29	.21	.84
	F	5.4 (2.2, 8.0)	8.3 (3.0, 12.4)	10.2 (4.3, 14.6)	9.4 (4.8, 13.2)	10.1 (4.0, 15)	8.7 (5.0, 13.4)			
NMEoocl (cmH ₂ O/ μV)	S	2.8 (1.5, 4.8)	2.0 (1.4, 5.1)	2.0 (1.3, 3.9)	2.0 (1.1, 3.3)	2.4 (1.4, 3.8)	2.0 (1.6, 4.5)	.89	.75	.34
	F	2.0 (1.5, 4.6)	2.0 (1.8, 3.6)	1.7 (1.2, 4)	1.7 (1.2, 5.2)	1.8 (1.3, 6.6)	2.1 (1.1, 4.1)			

Data are presented as median (interquartile range). No significant differences between two groups were observed at baseline and each time points during the spontaneous breathing trial. Within each group, comparison between the baseline and the first minute of the spontaneous breathing trial: † p <0.05, ‡ p <0.001. And comparison between the first minute after the start of the SBT and other time points after it: † P <0.05, ‡ P <0.001. SBT, spontaneous breathing trial; RR, respiratory rate; VT, tidal volume; PEEPi, intrinsic positive end-expiratory pressure; PTP, pressure-time-product; NVE, neuro-ventilatory efficiency; NMEdyn, dynamic neuro-mechanical efficiency; ΔPmus, global inspiratory muscles pressure; ΔEAdi, electrical activity of the diaphragm; NMEoocl, static neuro-mechanical efficiency.

Table S5 Respiratory parameters during the SBT in successful (S) and failed (F) ventilator liberation groups within 7 days after the SBT

Variables		Baseline	1MIN	5MIN	10MIN	20MIN	30MIN	P Value		
								Main Effects		Interaction
								Time	Group	
Tidal Volume (ml)	S	474.5 (352.2, 597.1)	403.0 (278.8, 524.3)‡	437.4 (336.3, 541.9)†	438.7 (321, 538.6)	388.0 (340.1, 537.4)	446.8 (341.9, 533.3)	.006	.65	.74
	F	450.9 (395.9, 724.7)	390.1(318.8, 561.3)‡	415.6 (335, 600.7)	449.0 (336.9, 602.9)	397.9 (348.9, 613.5)	397.2 (340.1, 616.6)			
Respiratory rate (Breath/min)	S	19.1 (15.8, 22.2)	21.4 (16.8, 25.6)‡	20.8 (16.9, 25.6)	22.5 (14.3, 24.7)	21.0 (15.6, 25.0)	21.7 (16.7, 25.8)	.05	.26	.42
	F	19.1 (14.4, 25.9)	22.1 (17, 27.9)†	20.5 (16.5, 28.9)	20.3 (17.3, 28.6)	20.8 (16.3, 29.0)	20.4 (17.9, 28.1)			
Minute ventilation (L)	S	9.0 (7.7, 10.4)	7.8 (6.4, 10.0)	8.6 (7.0, 9.8)	8.3 (7.1, 9.7)	8.4 (7.6, 10.1)	8.4 (7.8, 10.0)	.02	.50	.89
	F	10.5 (6.7, 12.2)	9.9 (6.9, 10.9)	9.7 (7.7, 10.7)	9 (7.6, 11.3)	9.1 (7.3, 11.4)	9.5 (7.6, 11.3)			
Inspiratory time(sec)	S	1.1 (0.9, 1.3)	1.1 (0.9, 1.2)	1.1 (0.9, 1.3)	1.0 (0.9, 1.3)	1.0 (1.0, 1.2)	1.1 (0.9, 1.2)	.017	.27	.87
	F	0.9 (0.9, 1.2)	1.0 (0.9, 1.2)	1.0 (0.8, 1.3)	1.0 (0.9, 1.3)	0.9 (0.9, 1.2)	1 (0.9, 1.2)			
Expiratory time(sec)	S	2.1 (1.8, 2.6)	1.8 (1.5, 2.3)†	1.9 (1.6, 2.3)	1.8 (1.5, 2.5)	1.8 (1.6, 2.5)	1.9 (1.4, 2.4)	.001	.54	.26
	F	2.1 (1.4, 2.9)	1.8 (1.3, 2.4)†	1.8 (1.2, 2.5)	2 (1.2, 2.3)	1.8 (1.2, 2.5)	1.8 (1.2, 2.3)			
Duty cycle (%)	S	32.7 (31.1, 39.2)	36.8 (34.3, 40.0)†	36.9 (33.9, 38.5)	37.1 (33.2, 40.7)	36.6 (34.2, 39.6)	37.8 (32.7, 41.3)	.22	.55	.32
	F	33.7 (29.0, 39.4)	37.9 (31.9, 40.6)†	36.1 (31.1, 40.3)	36.7 (30.4, 41.6)	36 (31.1, 41.8)	36.2 (32.2, 42.1)			
RR/VT (Breath•min ⁻¹ •L ⁻¹)	S	41.4 (25.8, 60.9)	52.9 (30.5, 87.8)‡	46.1 (30.4, 78.5)	43.3 (25.6, 83.5) †	52.5 (29.2, 75.2)	48.0 (32.2, 74.9)	.030	.88	.43
	F	38.6 (17.6, 54.5)	51.2 (26.7, 78.1)‡	52.3 (24.5, 70)	49.7 (25.7, 66.1)	48.4 (27.9, 71.5)	47.7 (28.8, 69.1)			
PEEPi (cmH ₂ O)	S	1.0(0.4, 1.6)	1.3 (0.6, 2.0)	1.0 (0.5, 2.1)	1.1 (0.5, 1.6)	0.9 (0.4, 1.8)	1.0 (0.3, 1.3)	.030	.60	.84
	F	1.0 (0.1, 1.6)	1.2 (0.5, 2.0)	1.1 (0.5, 1.5)	0.7 (0.3, 1.7)	0.8 (0.5, 1.2)	0.6 (0.1, 1.4)			
PTP per breath (cmH ₂ O•sec)	S	4.1 (1.7, 6.4)	7.1 (4.2, 8.5)†	7.0 (5.6, 9.3)	8.1 (5.9, 10.0)	7.3 (5.6, 9.7)	8.1 (5.7, 10.0)	.54	.66	.72
	F	4.7 (2.4, 7.4)	7.5 (5.0, 10.8)‡	8.4 (6.2, 11.6)	8.2 (5.6, 12.4)	8.5 (5.4, 11.6)	7.4 (5.7, 10.7)			
PTP per liter (cmH ₂ O•sec•L ⁻¹)	S	7.4 (4.5, 11.2)	17.1 (11.9, 22.4)‡	17 (12.9, 21.3)	18.2 (13.4, 22.6)	18 (13.6, 22.7)	18 (14.9, 22.6)	.54	.71	.92
	F	7.4 (6.1, 10.3)	16.7 (13.2, 23.7)‡	18.2 (12.3, 22.7)	18.2 (15.8, 22.4)	17.7 (15.2, 21)	17.7 (15.8, 19.9)			
NVE (ml/μV)	S	208.6 (119.5, 324.2)	67.9 (37.4, 125.3)	64.9 (44.0, 110.2)	63.2 (45.1, 115.8)	72.2 (41.4, 105.4)	66.1 (36.9, 115.2)	.55	.45	.62
	F	101.9 (64.0, 294.2)	53.0 (39.1, 191.3)	57.5 (29.5, 116.3)	55.1 (33.5, 138.9)	54.7 (30.1, 149.8)	50.1 (38.1, 97.9)			
NMEdyn (cmH ₂ O/ μV)	S	1.5 (0.8, 2.0)	1.2 (0.8, 1.8)	1.2 (0.9, 1.7)	1.2 (0.9, 2.5)	1.2 (1.0, 2.4)	1.1 (0.9, 1.8)	.25	.26	.82
	F	1.5 (0.8, 3.7)	1.5 (1.1, 4.2)	1.2 (1.0, 4.0)	1.5 (1.0, 3.6)	1.2 (1.0, 4.2)	1.7 (1.0, 3.0)			
ΔPmus (cmH ₂ O)	S	6.0 (1.8, 7.8)	8.7 (6.2, 11.5)‡	10.0 (8.3, 12.2)	11.3 (8.1, 13.2) †	10.8 (8.0, 12.9)	11.2 (8.4, 13.3)	.001	.23	.65
	F	7.9 (3.6, 10.1)	10.3 (8.1, 16.5)‡	11.0 (8.8, 16.1)	13.4 (8.9, 15.6)	12.5 (8.6, 18.5)	11.7 (8.7, 18.1)			
PTP per min (cmH ₂ O•min)	S	60.4 (38.9, 112.5)	142.3 (96.7, 187.7)‡	150.2 (103.5, 180.0)	142.3 (111.7, 197.7)	167.1 (113.9, 194.4)	162.7 (124.5, 195.7)	.47	.29	.93
	F	95.6 (36.1, 154.9)	176 (121.2, 239.9)‡	175.1 (121.5, 227.4)	167.5 (130.5, 221.2)	164.3 (136, 238.7)	167.8 (125.1, 213.9)			
ΔEAdi (μV)	S	2.4 (1.3, 4.4)	5.8 (3.4, 10.3)†	6.5 (3.8, 9.9)	6.3 (3.7, 10.9)	5.8 (3.7, 9.7)	6.8 (3.5, 12.3)	.39	.87	.47
	F	5.4 (2.2, 8)	8.3 (3, 12.4)‡	10.2 (4.3, 14.6)	9.4 (4.8, 13.2)	10.1 (4.0, 15.0)	8.7 (5.0, 13.4)			
NMEoocl (cmH ₂ O/ μV)	S	2.8 (1.5, 4.8)	2.0 (1.4, 5.1)	2.0 (1.3, 3.9)	2.0 (1.1, 3.3)	2.4 (1.4, 3.8)	2.0 (1.6, 4.5)	.69	.40	.81
	F	2.0 (1.5, 4.6)	2.0 (1.8, 3.6)	1.7 (1.2, 4.0)	1.7 (1.2, 5.2)	1.8 (1.3, 6.6)	2.1 (1.1, 4.1)			

Data are presented as median (interquartile range). No significant differences between two groups were observed at baseline and each time points during the spontaneous breathing trial. Within each group, comparison between the baseline and the first minute of the spontaneous breathing trial: † $P < 0.05$, ‡ $P < 0.001$. And comparison between the first minute after the start of the SBT and other time points after it: † $P < 0.05$, ‡ $P < 0.001$. SBT, spontaneous breathing trial; RR, respiratory rate; VT, tidal volume; PEEPi, intrinsic positive end-expiratory pressure; PTP, pressure-time-product; NVE, neuro-ventilatory efficiency; NMEdyn, dynamic neuro-mechanical efficiency; ΔPmus, global inspiratory muscles pressure; ΔEAdi, electrical activity of the diaphragm; NMEoocl, static neuro-mechanical efficiency.

Early and delayed extubation after the first SBT

Within 48 hours after the first SBT, 13 (28.3%) subjects were extubated, and 33 (71.7%) subjects were remained breathing through a T-tube circuit with humidified oxygen. The rate of failed ventilator liberation in subjects extubated and subjects without extubation were not different (4/13 (30.8%) vs. 13/33 (39.4%), respectively, $P = 0.74$).

Table S6 Respiratory parameters during the SBT in successful (S) and failed (F) ventilator liberation groups within 48 hours after the SBT in subjects remaining intubated within 48 hours

Variables		Baseline	1MIN	5MIN	10MIN	20MIN	30MIN	P Value		
								Main Effects		Interaction
								Group	Time*Group	Time*Group
Tidal Volume (ml)	S	511.2(376.7-592.8)	440.2(284.8-525) ‡	454.4(349.8-550)	445.0(347.8-539.9)	462.1(340.7-540.2) †	485.6(364.8-535.7) †	<.001	.83	.57
	F	450.9(400.8-686.7)	370.0(309.5-517.5) ‡	412(335-571.9)	392.7(330.1-583.9)	397.9(348.9-613.5)	388.8(340.1-616.6) †			
Respiratory rate (Breath/min)	S	18.7(16-22.2)	20.8(17-23.1) †	20.2(17.6-22.3)	20.6(15.1-23.4)	20.8(16.7-24)	20.0(16.9-24.4)	.44	.17	.72
	F	20.4(16.5-27)	23.3(18.7-29) †	24.0(17.1-29.6)	23.1(17.8-29.1)	22.9(18.1-29.3)	20.9(18.5-29.9)			
Minute ventilation (L)	S	9.2(8.2-10.5)	7.9(6.4-10.1)	9.4(7.5-9.9)	8.5(7.3-10.1)	8.9(7.8-10.3)	8.7(7.9-10.6) †	.002	.23	0.91
	F	10.5(7.2-12.1)	10.3(7.0-11.5) †	10.1(7.7-10.8)	10.0(7.6-11.7)	10.5(7.8-11.9)	10.6(7.6-11.4)			
Inspiratory time(sec)	S	1.14(0.97-1.29)	1.13(1.01-1.23)	1.13(0.98-1.35)	1.08(0.92-1.4)	1.05(0.98-1.25)	1.09(1.02-1.38)	.18	.09	.28
	F	0.91(0.89-1.18)	0.93(0.84-1.12)	0.95(0.83-1.16)	0.98(0.85-1.17)	0.94(0.84-1.15)	0.97(0.86-1.14)			
Expiratory time(sec)	S	2.13(1.87-2.48)	1.85(1.58-2.22) †	1.9(1.77-2.23)	1.80(1.60-2.42)	1.83(1.59-2.28)	1.91(1.49-2.29)	.08	.28	.51
	F	2.05(1.32-2.61)	1.58(1.2-1.95) †	1.54(1.17-2.2)	1.64(1.17-2.23)	1.7(1.16-2.05)	1.71(1.12-2.17)			
Duty cycle (%)	S	32.7(32.2-39.7)	36.6(32.2-40)	37.0(34.5-38.4)	36.9(33.6-41.1)	36.7(35.3-39.7)	37.9(33.6-41.6)	.62	.49	.75
	F	35.9(29.8-40.1)	39.1(34.8-41.4) †	37.7(33.3-40.6)	38.8(31.7-42.1)	38.6(33.3-42.1)	36.5(33.9-42.4)			
RR/VT (Breath•min ⁻¹ •L ⁻¹)	S	41.0(26-60.6)	49.4(29.6-80.2) ‡	42.4(33.9-69.2) †	43.0(27.3-76.1)	43.1(31.3-73.5)	46.8(32.4-59.8)	.017	.85	.59
	F	40.4(21.4-55.4)	62.2(34.5-84.5) ‡	52.3(30.7-80.2)	54.8(29.2-71.8)	48.4(29.4-74)	47.7(28.9-71)			
PEEPi (cmH ₂ O)	S	1.0(0.4-1.5)	1.3(0.6-1.9)	1.0(0.5-1.9)	1.1(0.3-1.6)	0.9(0.3-1.7)	0.7(0.2-1.1)	.08	.72	.83
	F	1.1(0.0-1.7)	1.2(0.5-2)	1.1(0.6-1.5)	1.3(0.2-2)	0.7(0.5-1.2)	0.5(0.1-1.2)			
PTP per breath (cmH ₂ O•sec)	S	4.1(1.4-6.4)	7.5(5-8.5) ‡	7.1(6.5-9.3)	8.1(5.9-10)	7.7(5.8-9.7)	8.4(7.4-10.5)	.021	.84	.52
	F	5.0(2.9-7.7)	7.1(4.3-10.2) †	8.4(3.9-11.6)	7.7(5-12.2)	8.5(5.6-11.6)	7.4(5.7-10.7) †			
PTP per liter (cmH ₂ O•sec•L ⁻¹)	S	7.4(3.5-10.8)	17.1(11.5-19.4) ‡	17.0(12.8-21.0)	19.0(13.1-21.0)	18.0(12.9-22.1)	19.0(12.4-21.9)	.27	.82	.79
	F	8.5(5.5-12.3)	16.1(12.5-23.3) ‡	17.8(11.2-22.7)	18.6(13.7-23.2)	17.7(11.9-23.1)	17.5(14.1-19.9)			
NVE (ml/μV)	S	203.9(127.8-343.5)	76.7(39.9-136.7)	72.3(48.3-127.5)	80.7(56.6-119.1)	86.4(46.8-126.4)	79.8(51.6-115.4)	.70	.56	.54
	F	101.9(61-232.4)	48.6(40.1-161.6) †	57.5(27.4-116.3)	45.8(31-138.9)	41.5(27.5-149.8)	50.1(34.6-97.9)			
NMEdyn (cmH ₂ O/ μV)	S	1.6(1-2.1)	1.2(0.9-2.4)	1.2(1-2.8)	1.3(1-3)	1.4(1-3)	1.2(0.9-2.4)	.029	.42	.80
	F	1.2(0.8-4.1)	1.4(1.1-3.9)	1.3(1.1-4)	1.6(1-3.6)	1.2(1-4.2)	1.6(0.9-2.8)			
ΔPmus (cmH ₂ O)	S	6.4(2.6-7.8)	8.8(6.2-11.3) †	10(8.9-12.2)	11.4(8.1-13.2)	11.1(7.7-12.9)	11.6(9.1-14.1) †	.002	.17	.50
	F	7.9(4.6-11.2)	9.1(7.8-15.9)	11.1(7.7-16.1)	13.7(8.6-15.6)	13.8(9.7-18.5)	12(9-17.3)			
PTP per min (cmH ₂ O•min)	S	76.8(29.4-112.5)	142.3(91.1-186.9) ‡	154.8(142-174.2)	177.7(104.5-199.9)	172.1(117.2-206.2)	172.2(134.5-199.7) †	.071	.29	.30
	F	101.8(50.1-156.7)	198.6(98.9-237.2) ‡	178.7(121.5-227.4)	186.1(134.0-235.2)	182.0(152.8-268.3)	177.3(130.7-213.9)			
ΔEAdi (μV)	S	2.3(1.1-4.4)	5.9(2.8-8.5)	6.6(3.5-8.5)	4.5(3.7-10.1)	5.5(3.5-9.4)	6.0(3.2-11.7)	.17	.10	.48
	F	5.4(2.5-7.6)	8.1(3.8-11.0) †	9.3(4.3-13.7)	9.4(4.8-12.2)	10.1(4.0-15.5)	8.7(5.0-11.2)			
NMEoocl (cmH ₂ O/ μV)	S	3.2(1.7-4.4)	2.1(1.5-6.9)	2.0(1.4-4.5)	2.2(1.3-3.3)	2.7(1.7-4.9)	2.4(1.6-4.7)	.83	.48	.31
	F	1.8(1.5-4.4)	2.0(1.9-3.3)	1.7(1.3-4.0)	1.6(1.2-5.2)	1.9(1.3-6.6)	2.3(1.2-4.1)			

Data are presented as median (interquartile range). No significant differences between two groups were observed at baseline and each time points during the spontaneous breathing trial. Within each group, comparison between the baseline and the first minute of the spontaneous breathing trial: † P <.05, ‡ P <.001. And comparison between the first minute after the start of the SBT and other time points after it: † P <.05, ‡ P <.001. SBT, spontaneous breathing trial; RR, respiratory rate; VT, tidal volume; PEEPi, intrinsic positive end-expiratory pressure; PTP, pressure-time-product; NVE, neuro-ventilatory efficiency; NMEdyn, dynamic neuro-mechanical efficiency; ΔPmus, global inspiratory muscles pressure; ΔEAdi, electrical activity of the diaphragm; NMEoocl, static neuro-mechanical efficiency.

Definition of the brain-injured patients screened:

Potential candidates for this study are brain-injured patients including:

- Traumatic brain injury (TBI, including contusion, brain hemorrhages, shearing lesions, and subdural and epidural hematomas)
- Stroke
- Global cerebral ischemia (for example, after cardiac arrest)
- Infections of the brain
- Brain tumor (including post neurosurgical status)