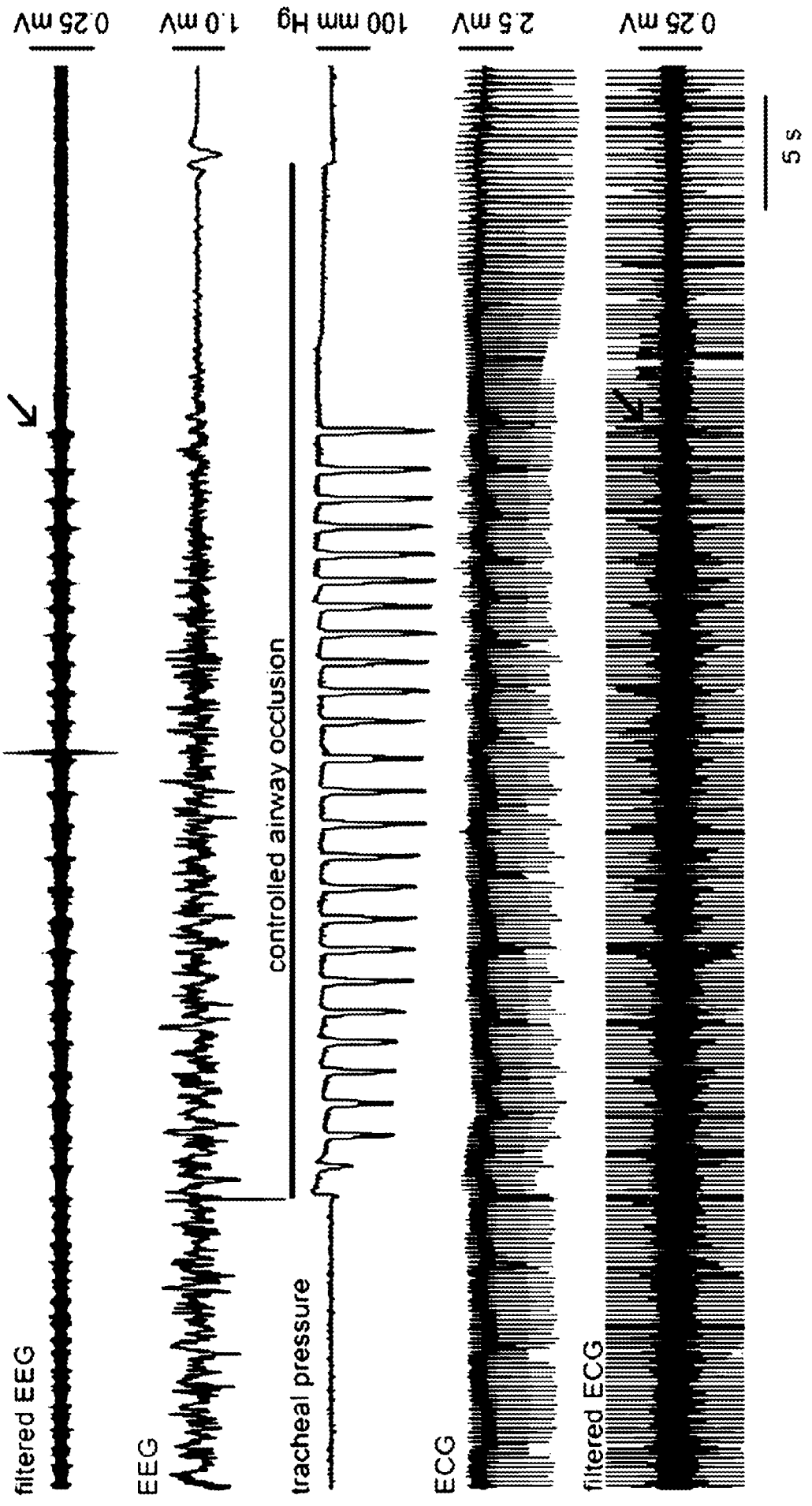

filtered EEG
0.25 mV
EEG
1.0 mV
tracheal pressure
100 mm Hg
controlled airway occlusion
ECG
2.5 mV
filtered ECG
0.25 mV
5 s

Fig. 1A

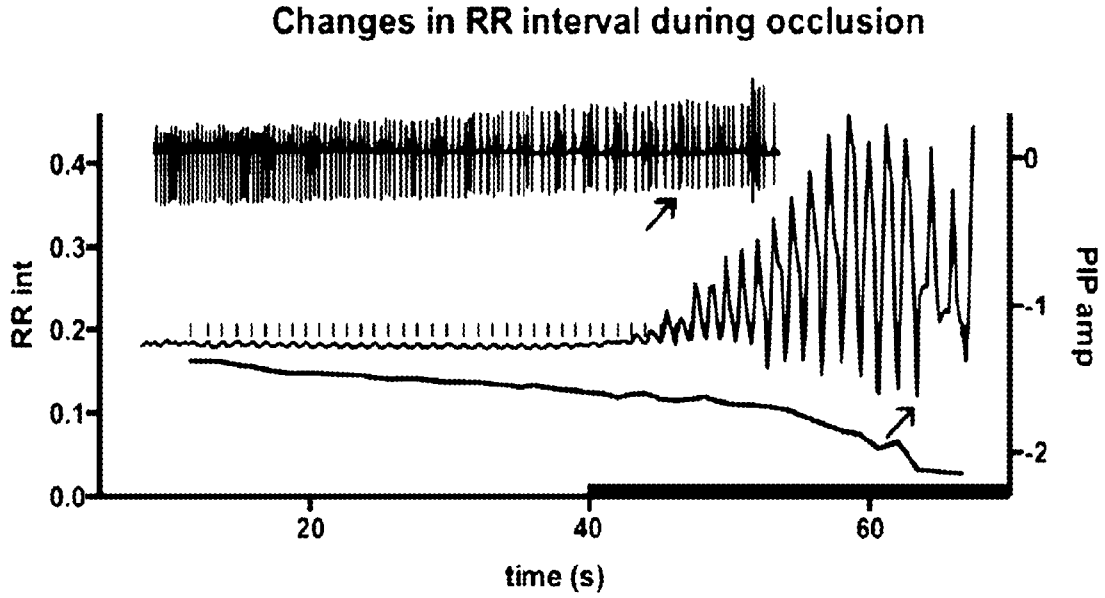


Fig. 1B

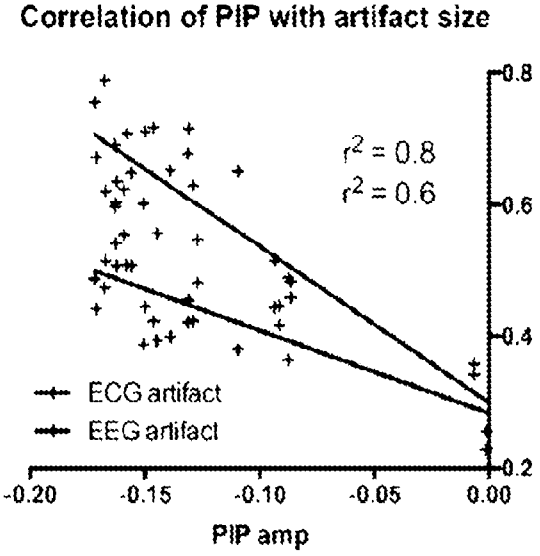


Fig. 1C

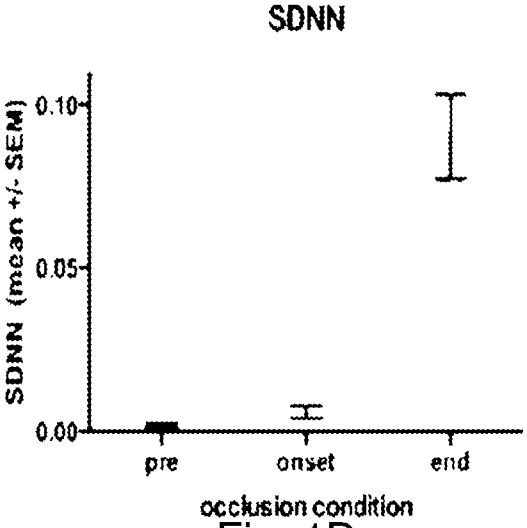


Fig. 1D

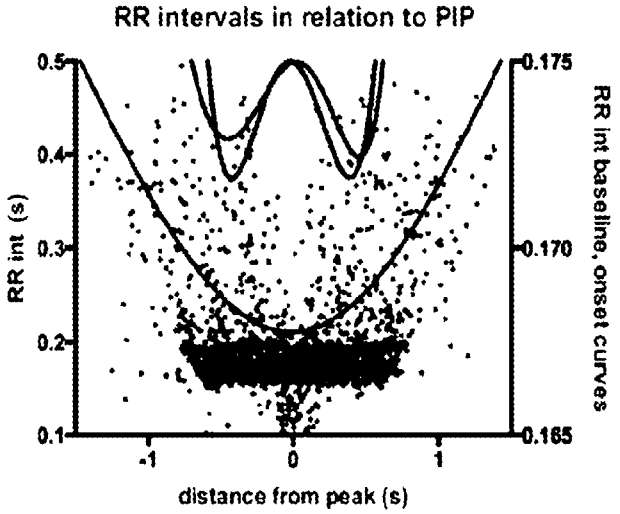


Fig. 1E

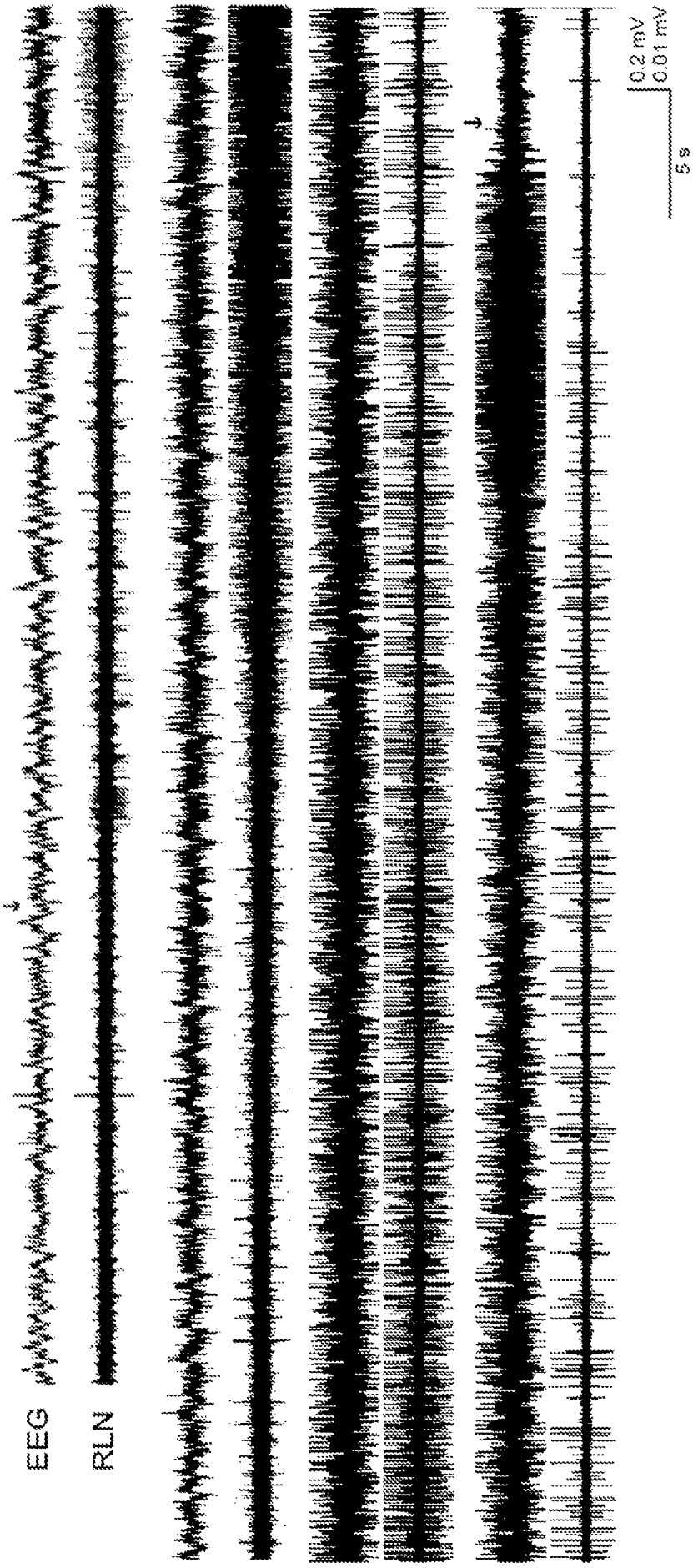
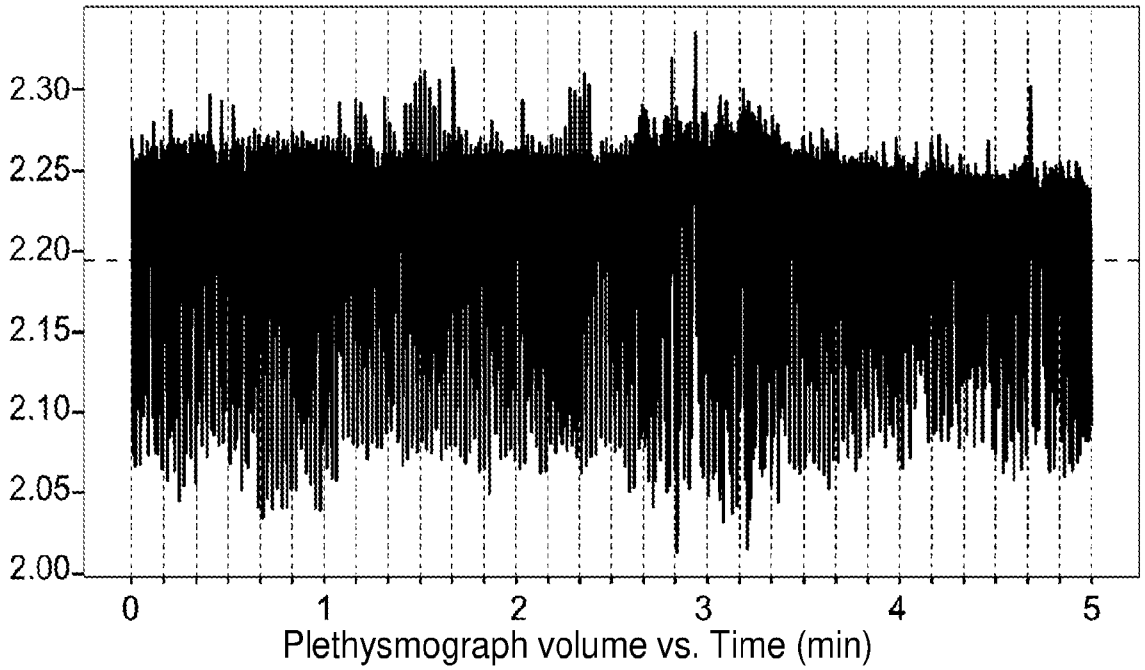
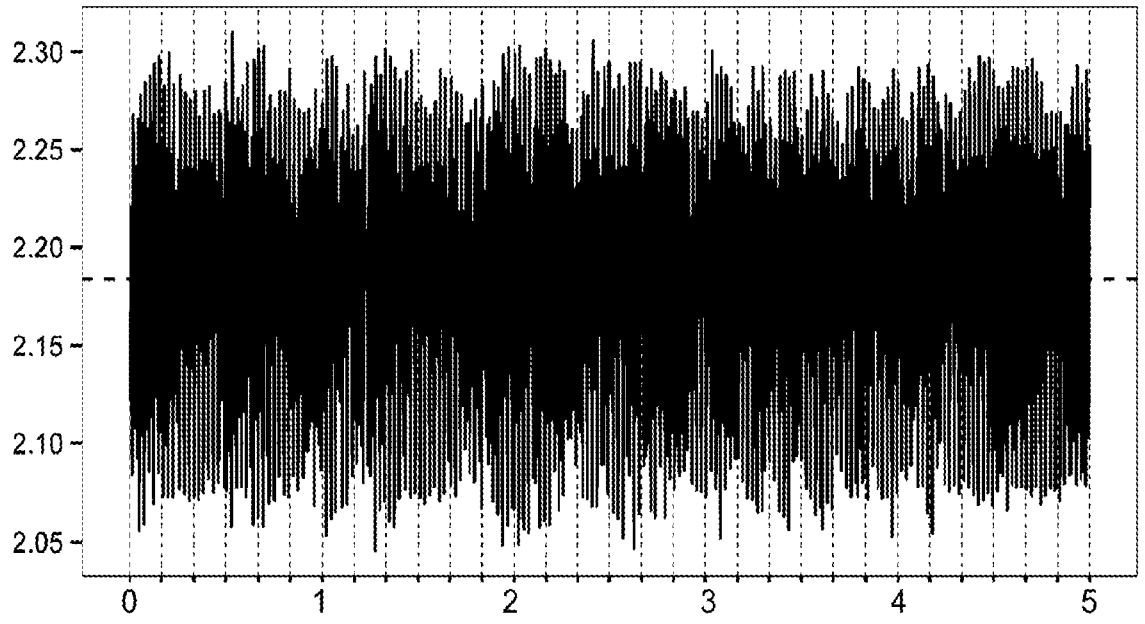


Fig. 2

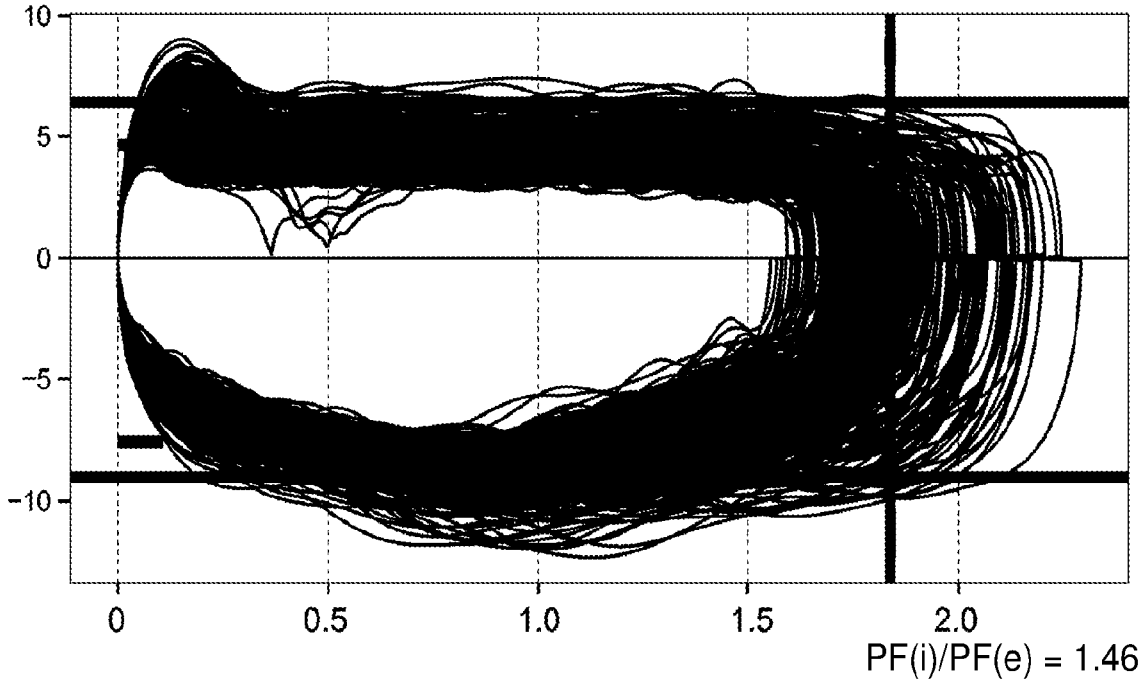


A1. Non-intubated Baseline



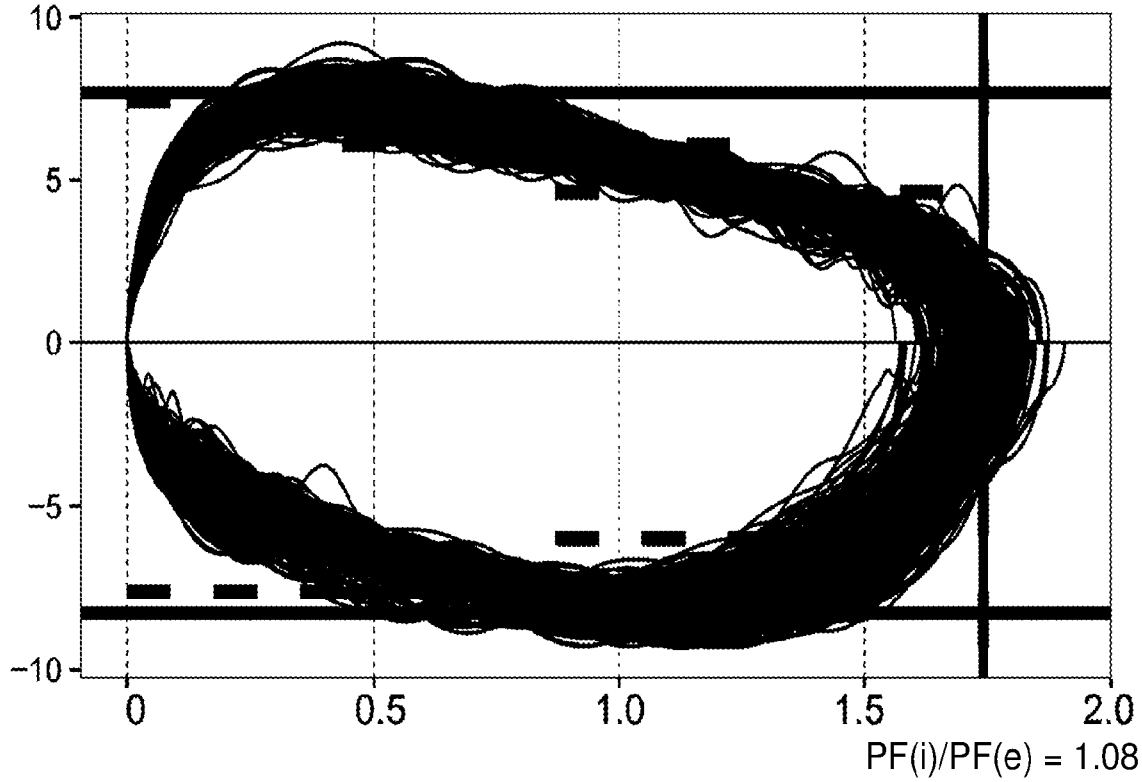
B1. Intubated Baseline

Fig. 3-1



Flow (ml/sec) vs. Volme (ml)

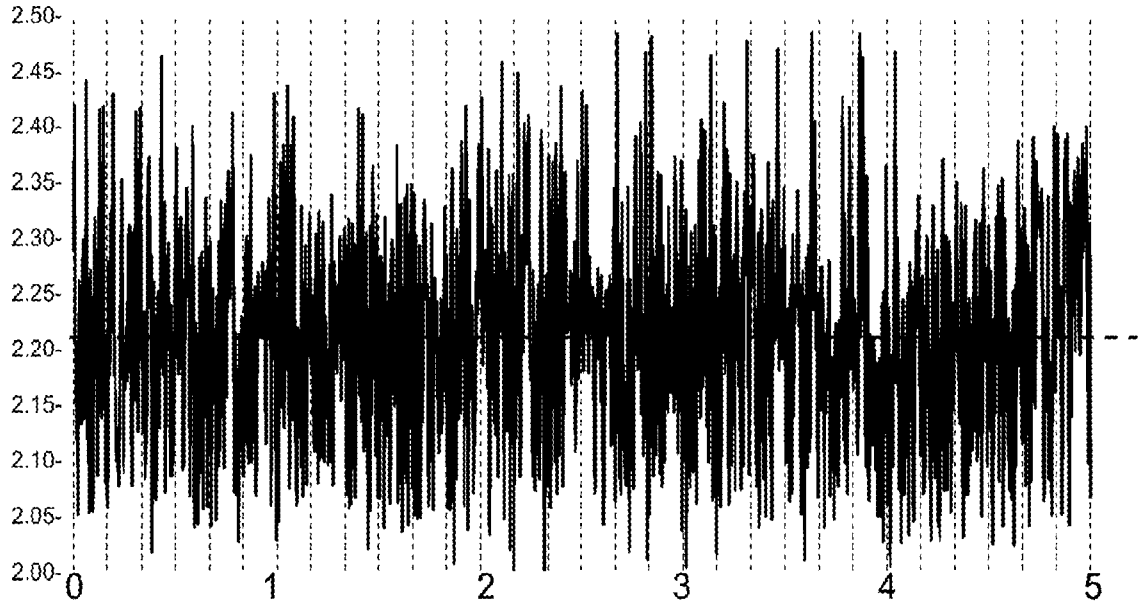
A2. Non-intubated Baseline



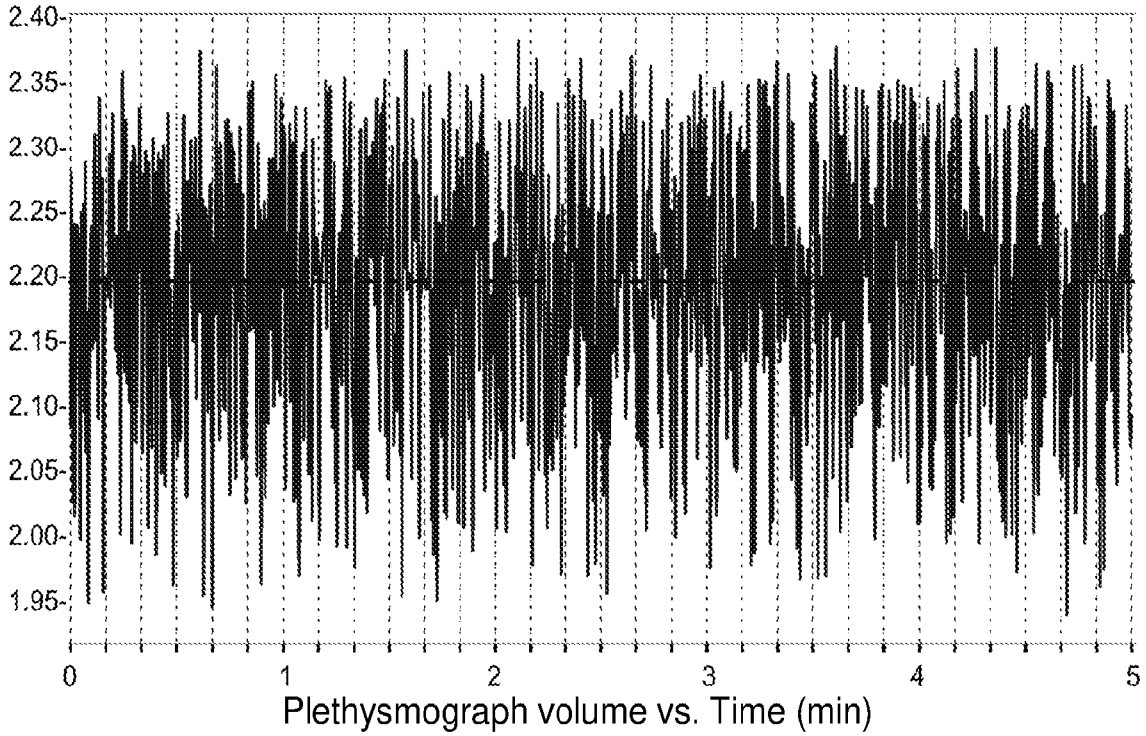
Flow (ml/sec) vs. Volme (ml)

B2. Intubated Baseline

Fig. 3-2

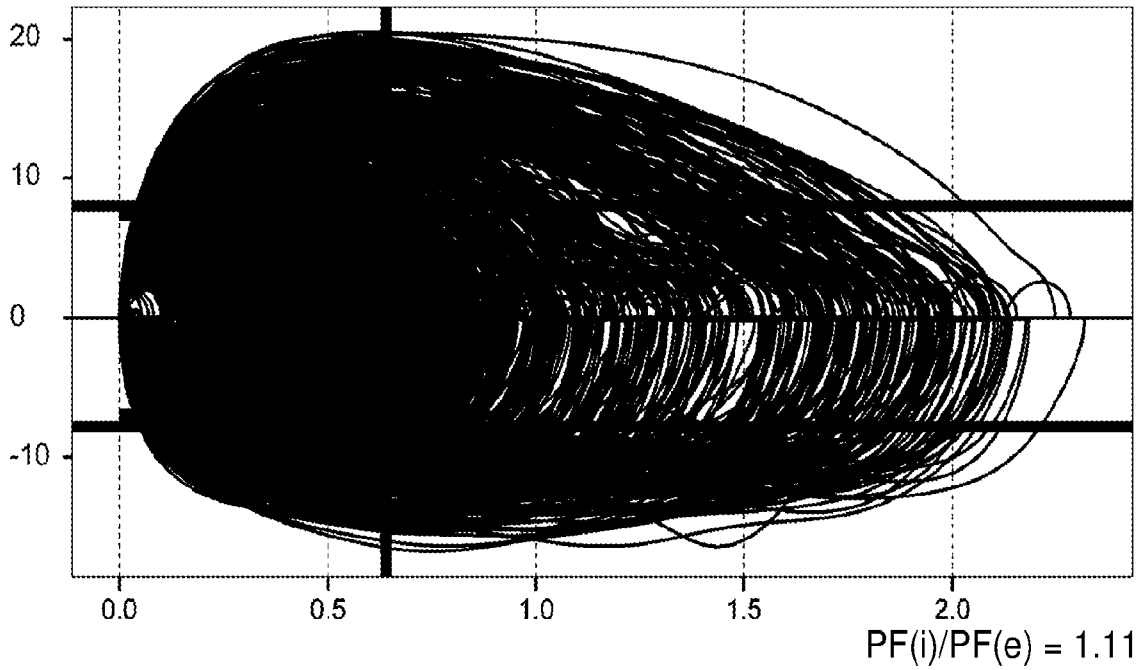


C1. Non-intubated Seizure



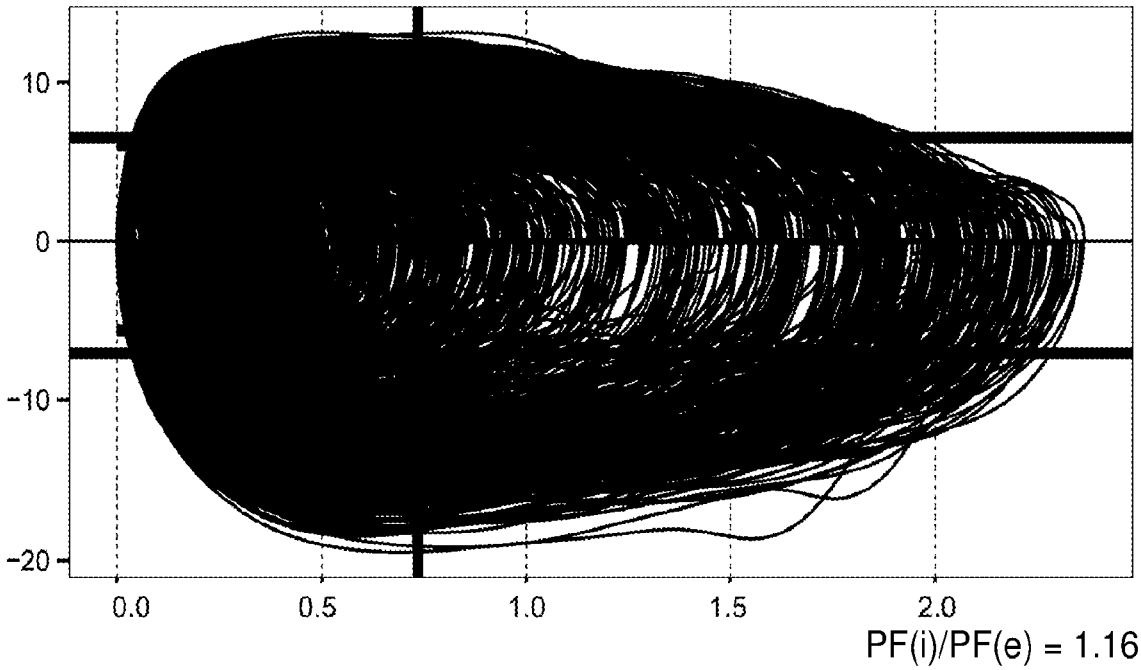
D1. Intubated Seizure

Fig. 3-3



Flow (ml/sec) vs. Volme (ml)

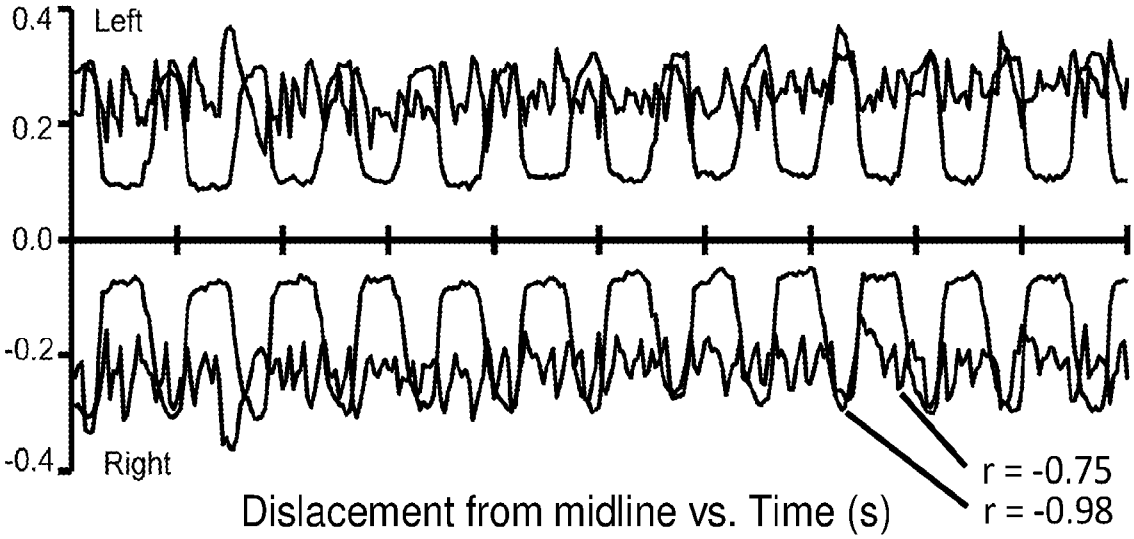
C2. Non-intubated Seizure



Flow (ml/sec) vs. Volme (ml)

D2. Intubated Seizure

Fig. 3-4



Dislacement from midline vs. Time (s)
Movement of Aretenoid Cartilage

Fig. 4A

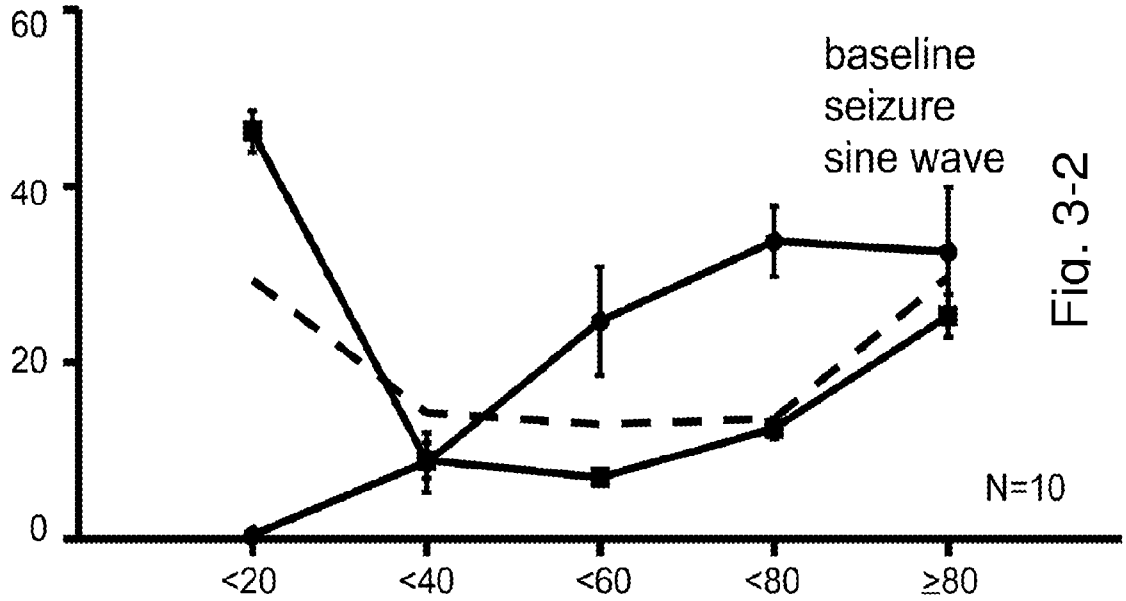


Fig. 3-2

Fraction of time vs. Fraction of peak-to-peak glottic opening

Fig. 4B

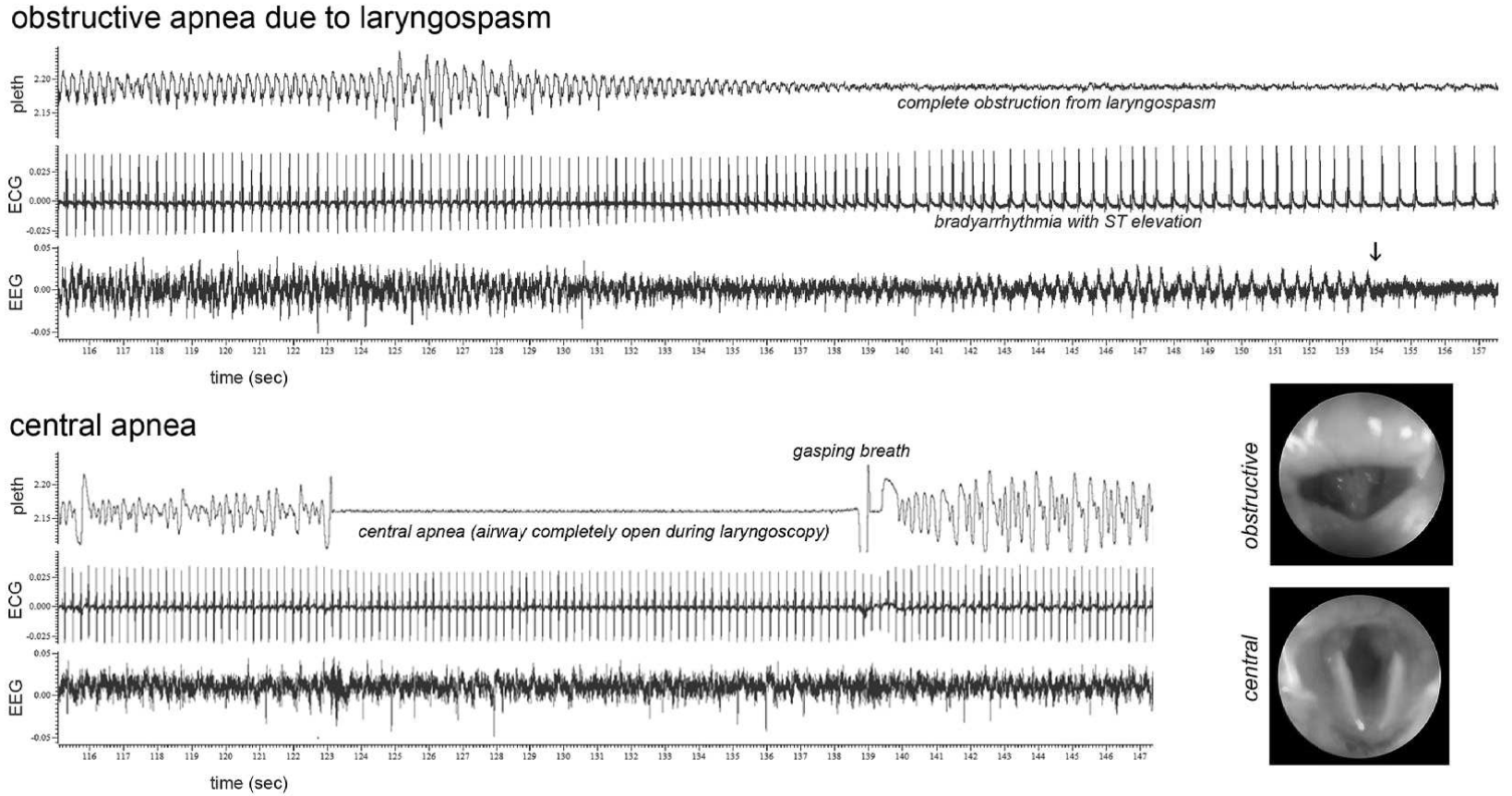

obstructive apnea due to laryngospasm
pleth
ECG
EEG
complete obstruction from laryngospasm
bradyarrhythmia with ST elevation
time (sec)
central apnea
gasping breath
central apnea (airway completely open during laryngoscopy)
time (sec)
obstructive
central

Fig. 5

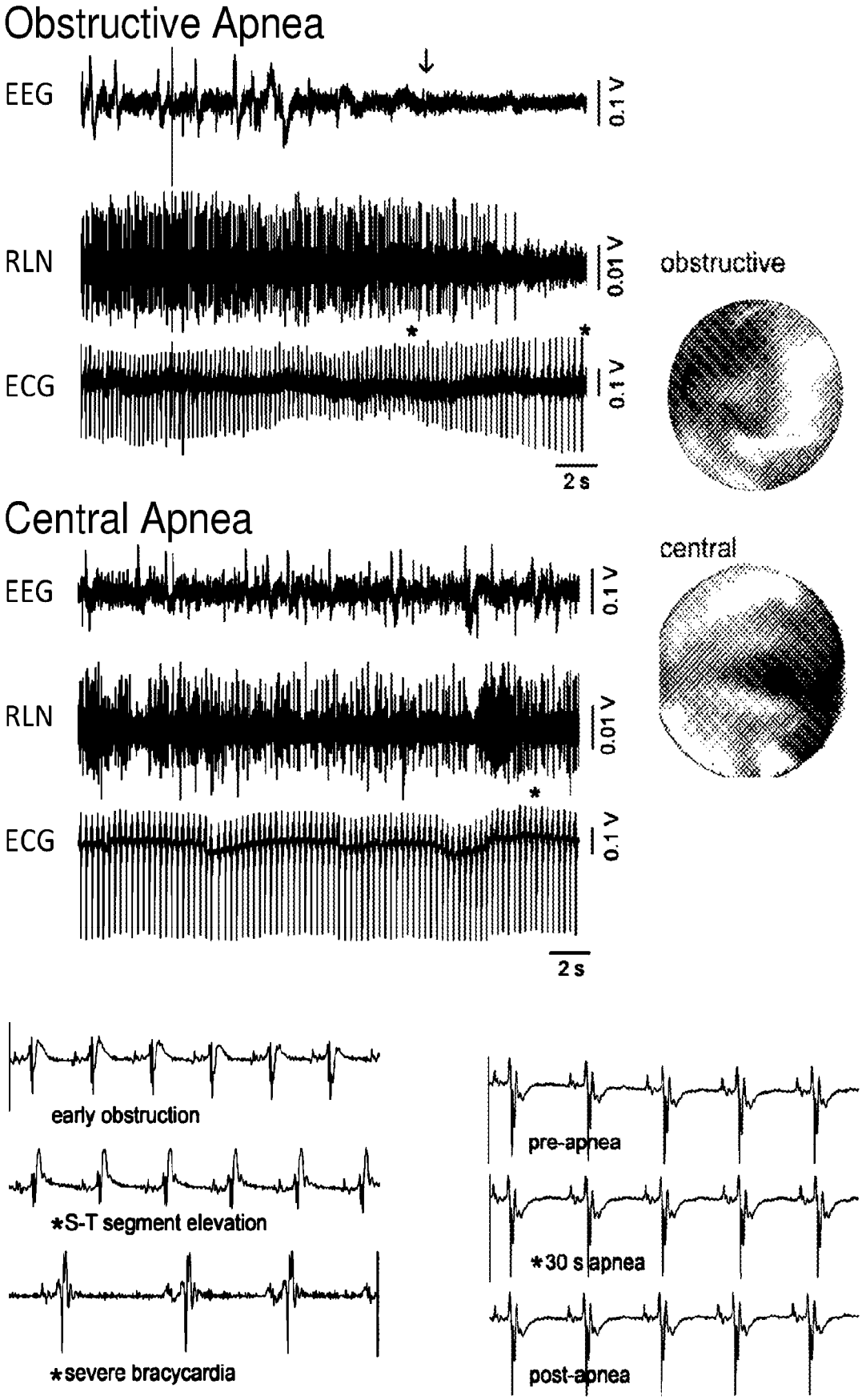

Obstructive Apnea
EEG
RLN
ECG
0.1 V
0.01 V
0.1 V
2 s
obstructive
Central Apnea
EEG
RLN
ECG
0.1 V
0.01 V
0.1 V
2 s
central
early obstruction
*S-T segment elevation
*severe bracycardia
pre-apnea
*30 s apnea
post-apnea

Fig. 6

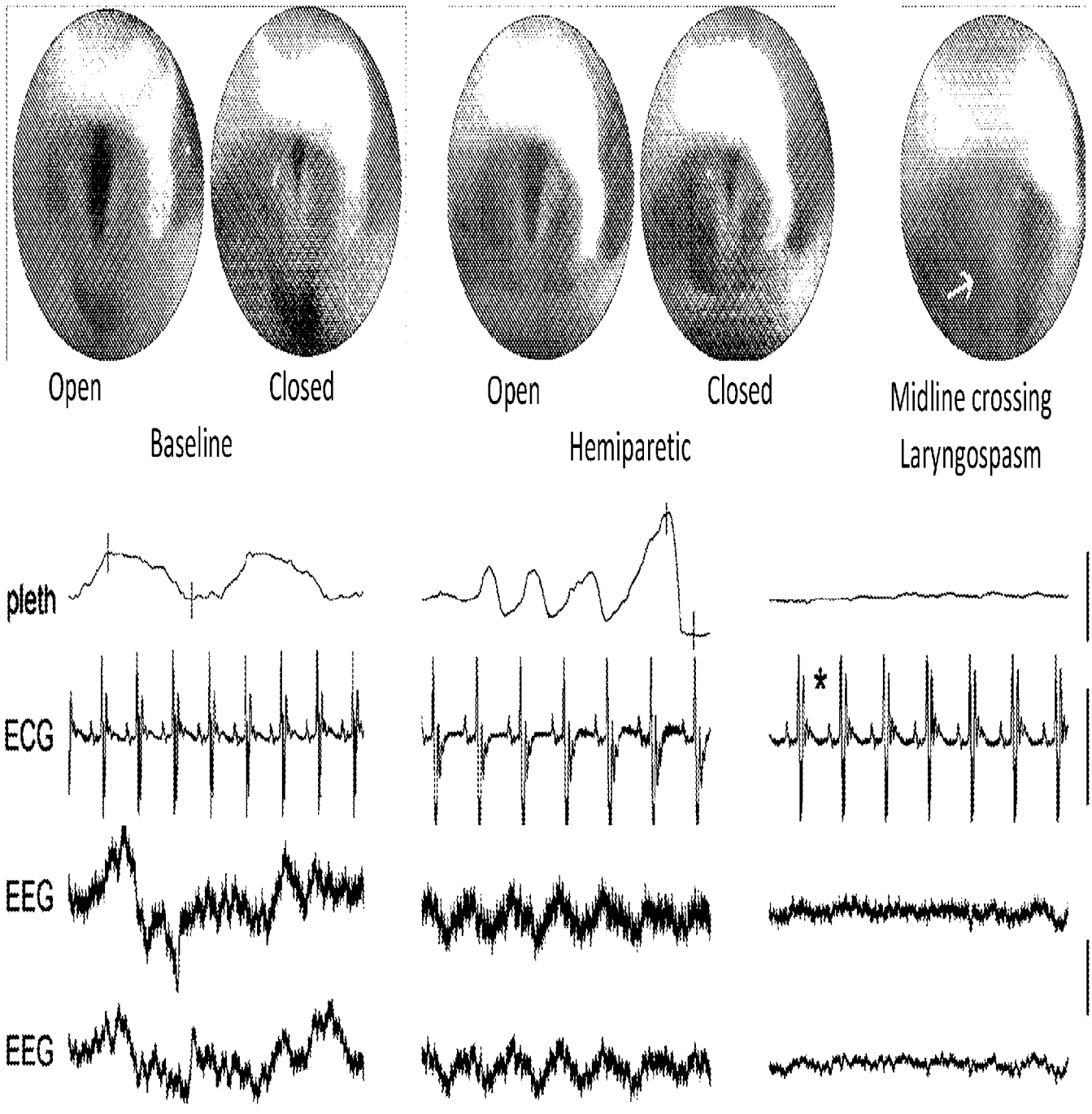

Open
Closed
Baseline
Open
Closed
Hemiparetic
Midline crossing
Laryngospasm
pleth
ECG
EEG
EEG
*

Fig. 7

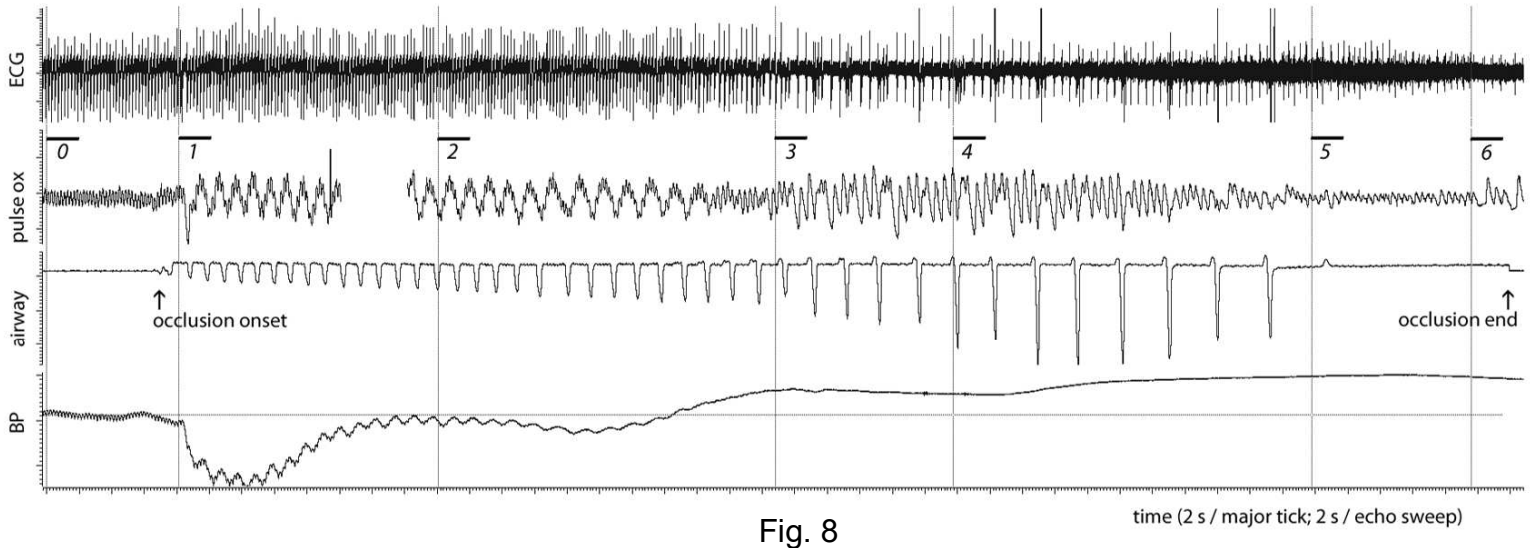

ECG
pulse ox
airway
BP
0
1
2
3
4
5
6
occlusion onset
occlusion end
time (2 s / major tick; 2 s / echo sweep)

Fig. 8

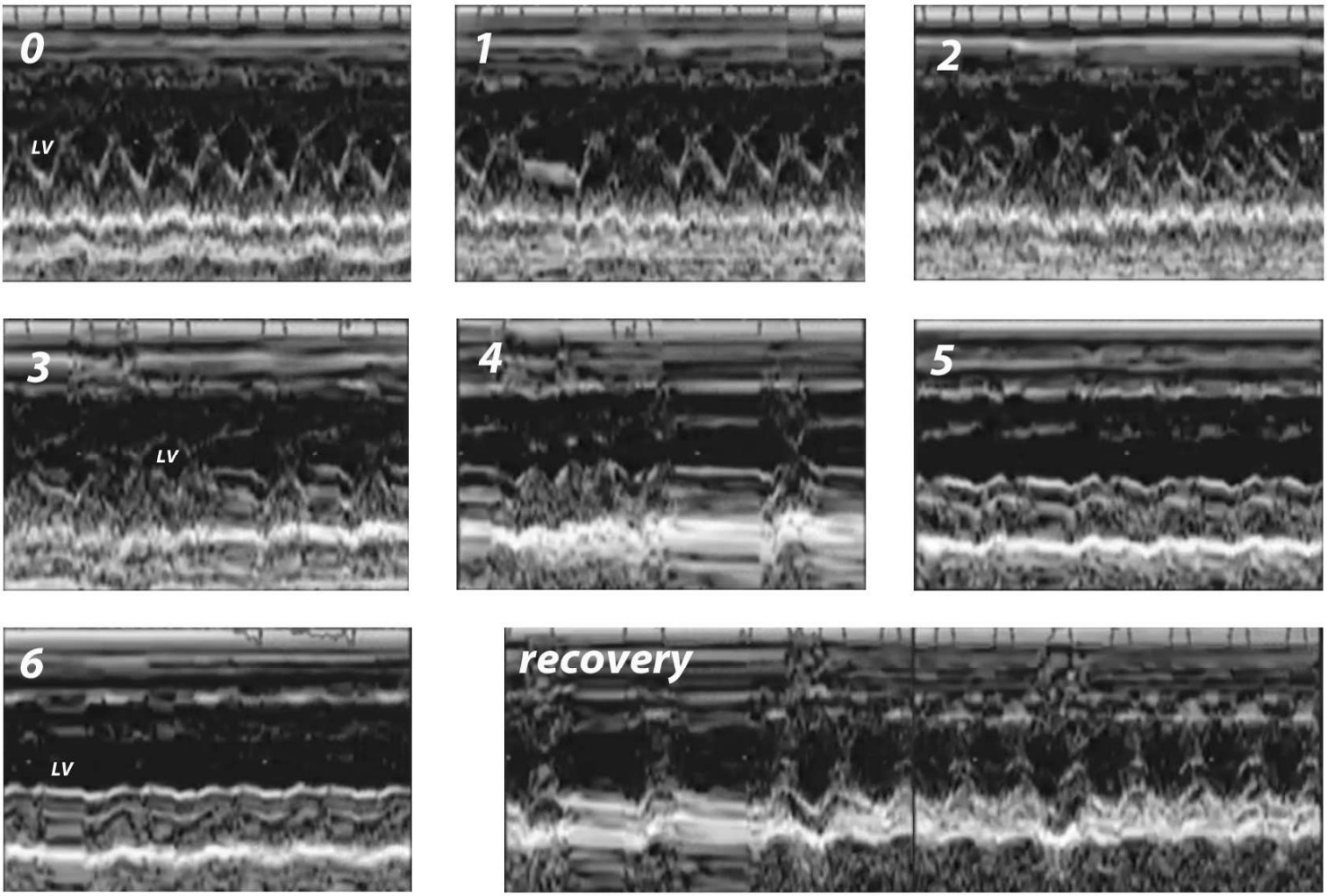

0
LV
1
2
3
LV
4
5
6
LV
recovery

Fig. 9

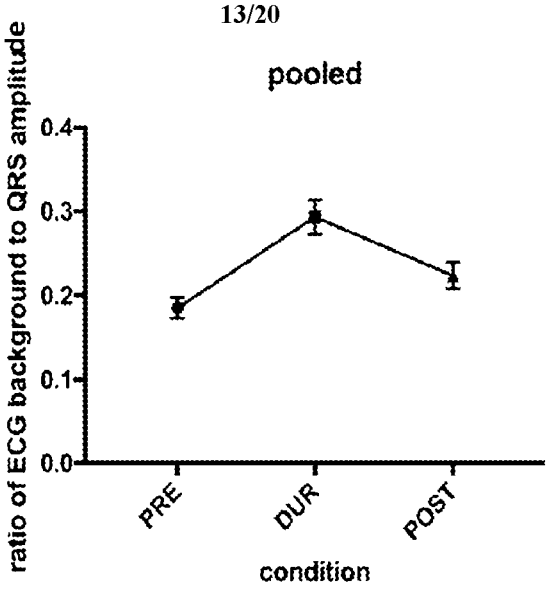

pooled
ratio of ECG background to QRS amplitude
0.4
0.3
0.2
0.1
0.0
PRE
DUR
POST
condition

Fig. 10

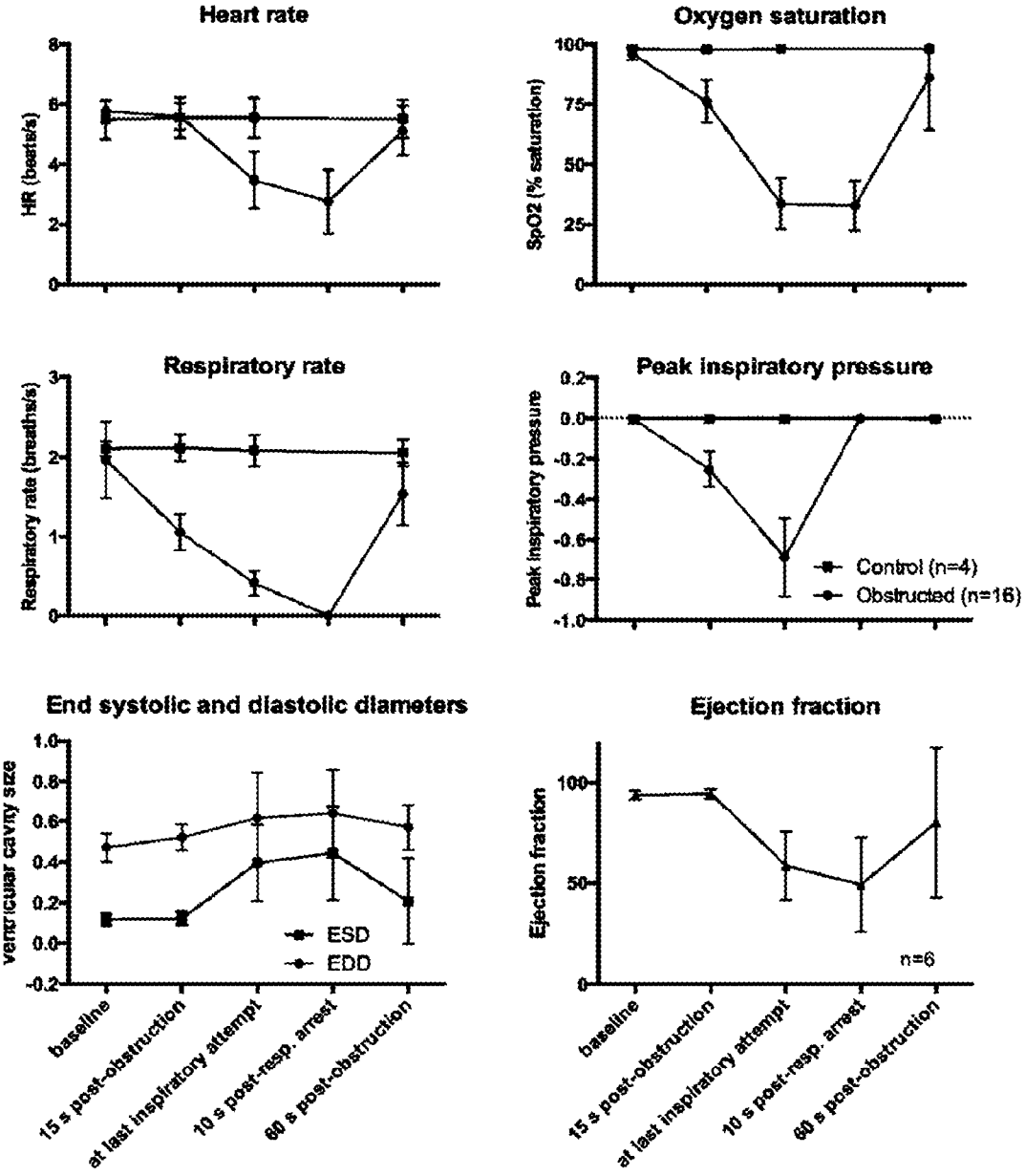

Heart rate
HR (beats/s)
Oxygen saturation
SpO2 (% saturation)
Respiratory rate
Respiratory rate (breaths/s)
Peak inspiratory pressure
Peak inspiratory pressure
Control (n=4)
Obstructed (n=16)
End systolic and diastolic diameters
ventricular cavity size
ESD
EDD
Ejection fraction
Ejection fraction
n=6
baseline
15 s post-obstruction
at last inspiratory attempt
10 s post-resp. arrest
60 s post-obstruction

Fig. 11

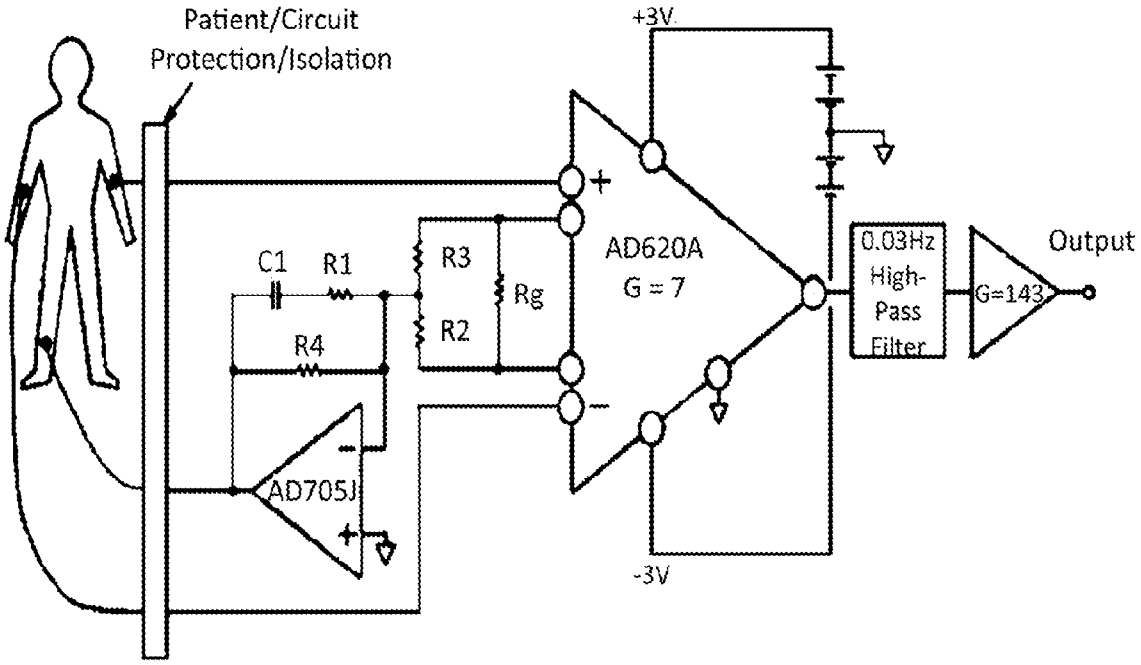


Fig. 12 Prior Art

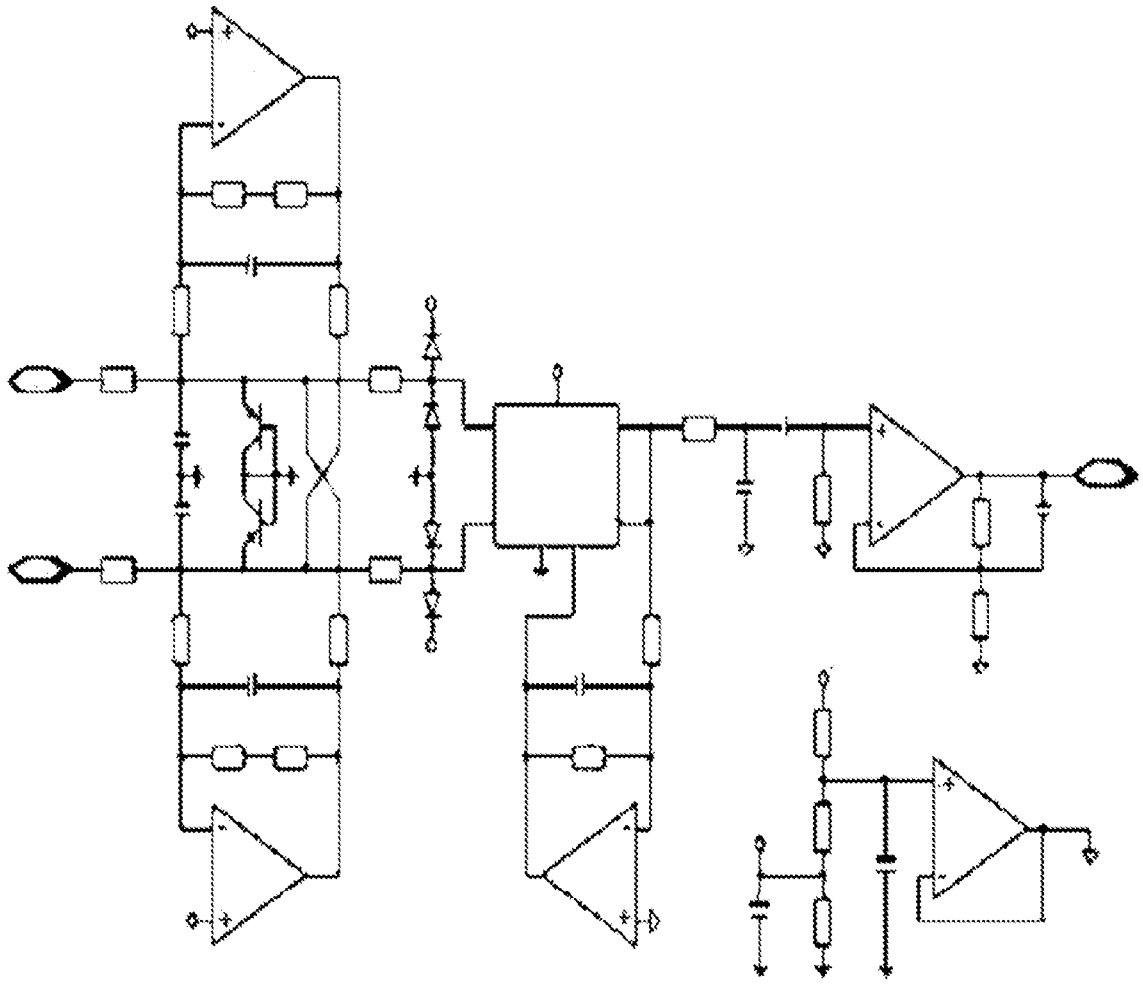


Fig. 13 Prior Art

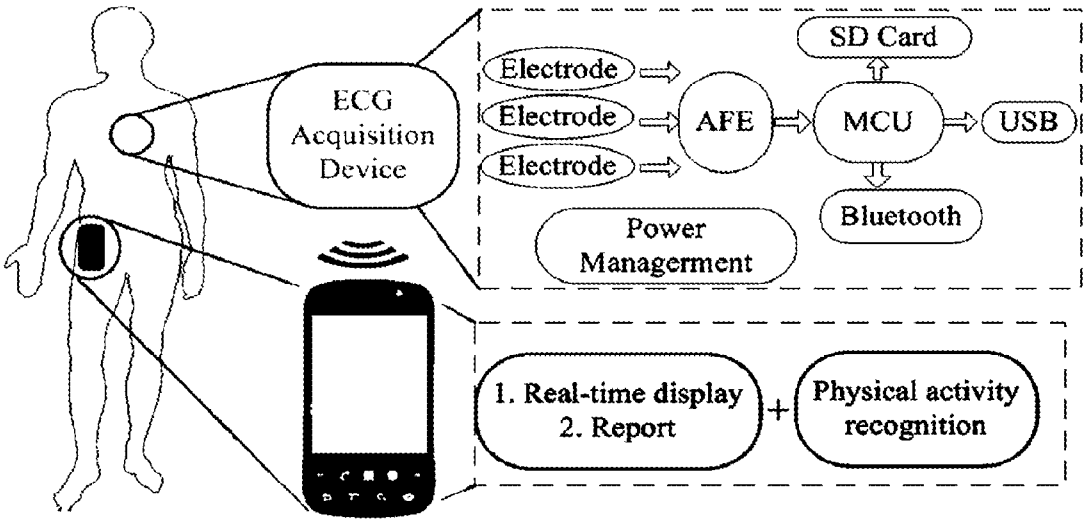


Fig. 14 Prior Art

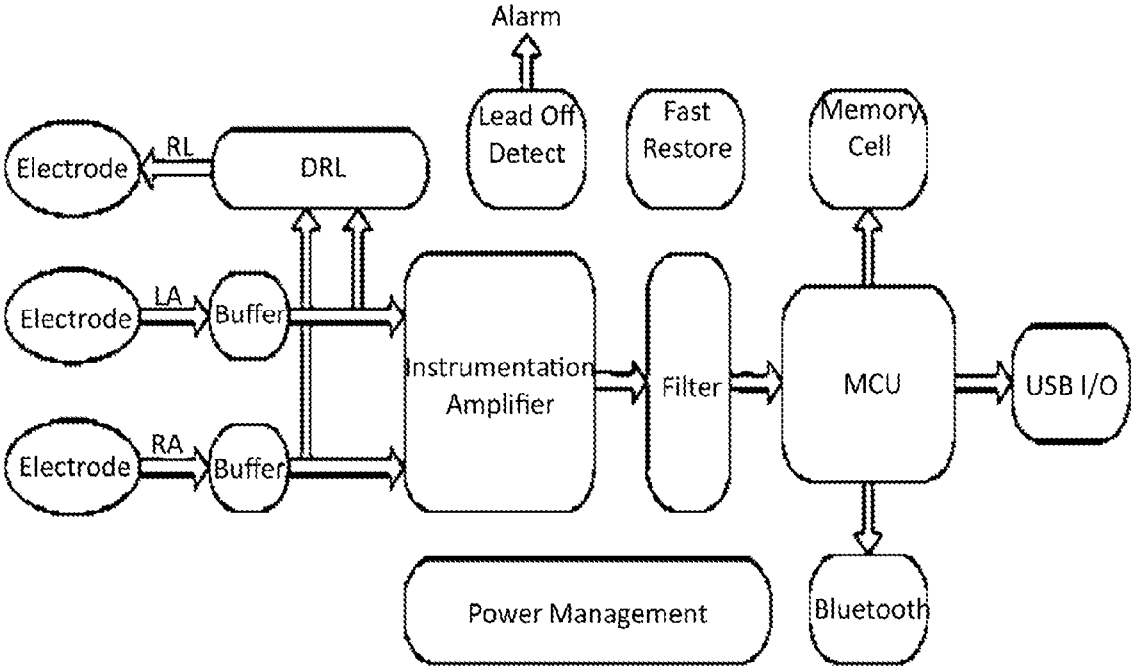


Fig. 15 Prior Art

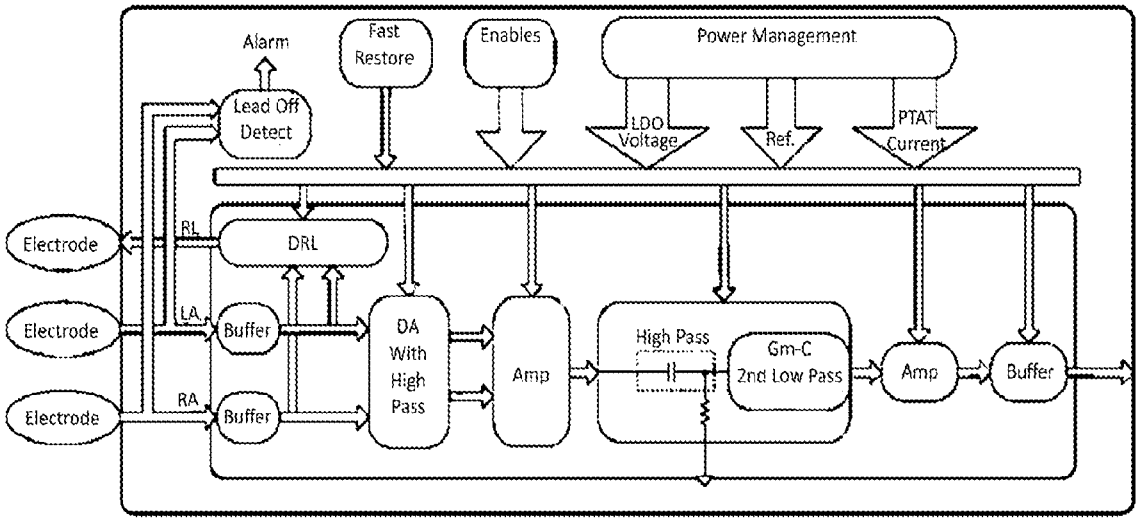


Fig. 16 Prior Art

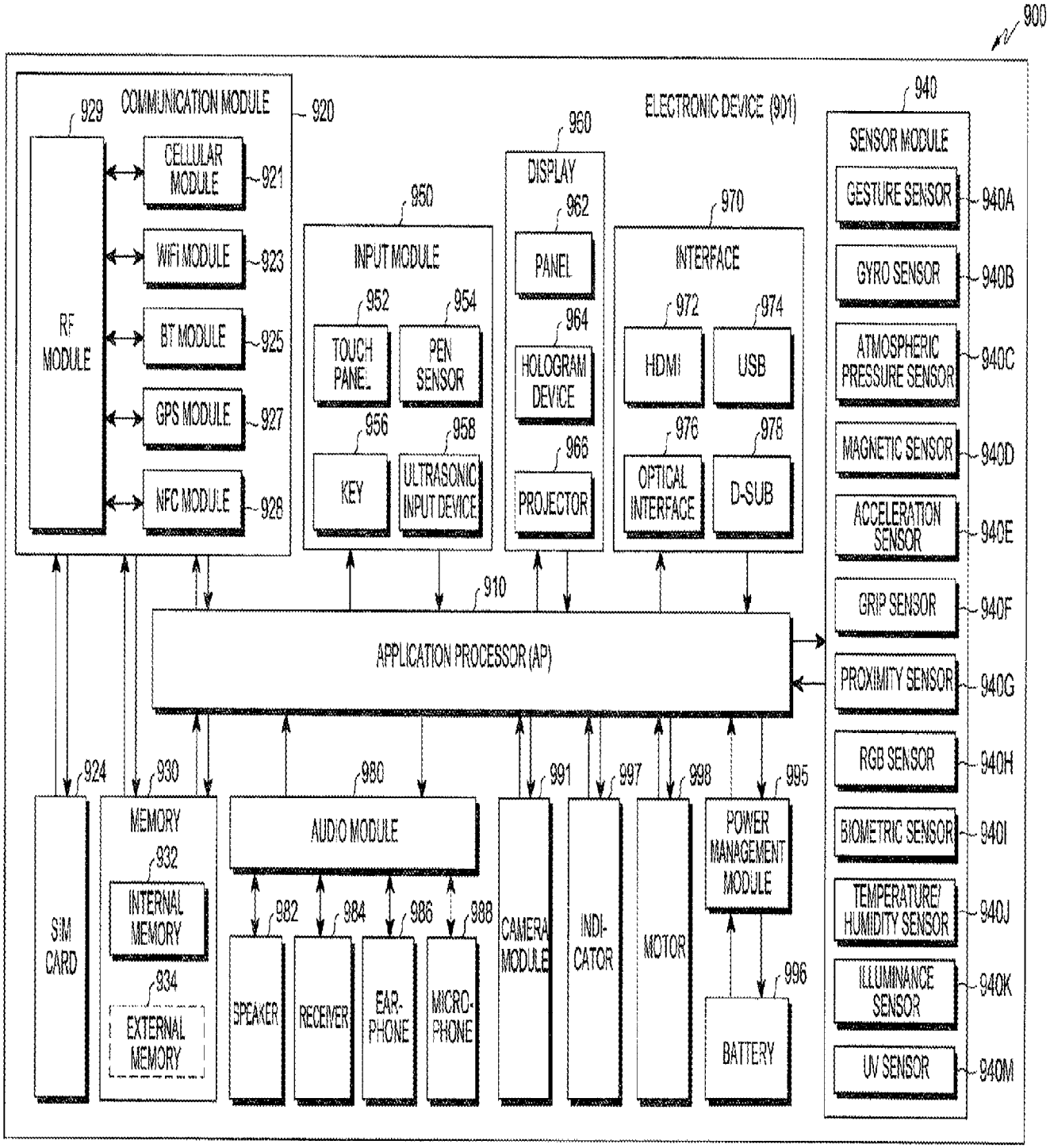


Fig. 17 Prior Art

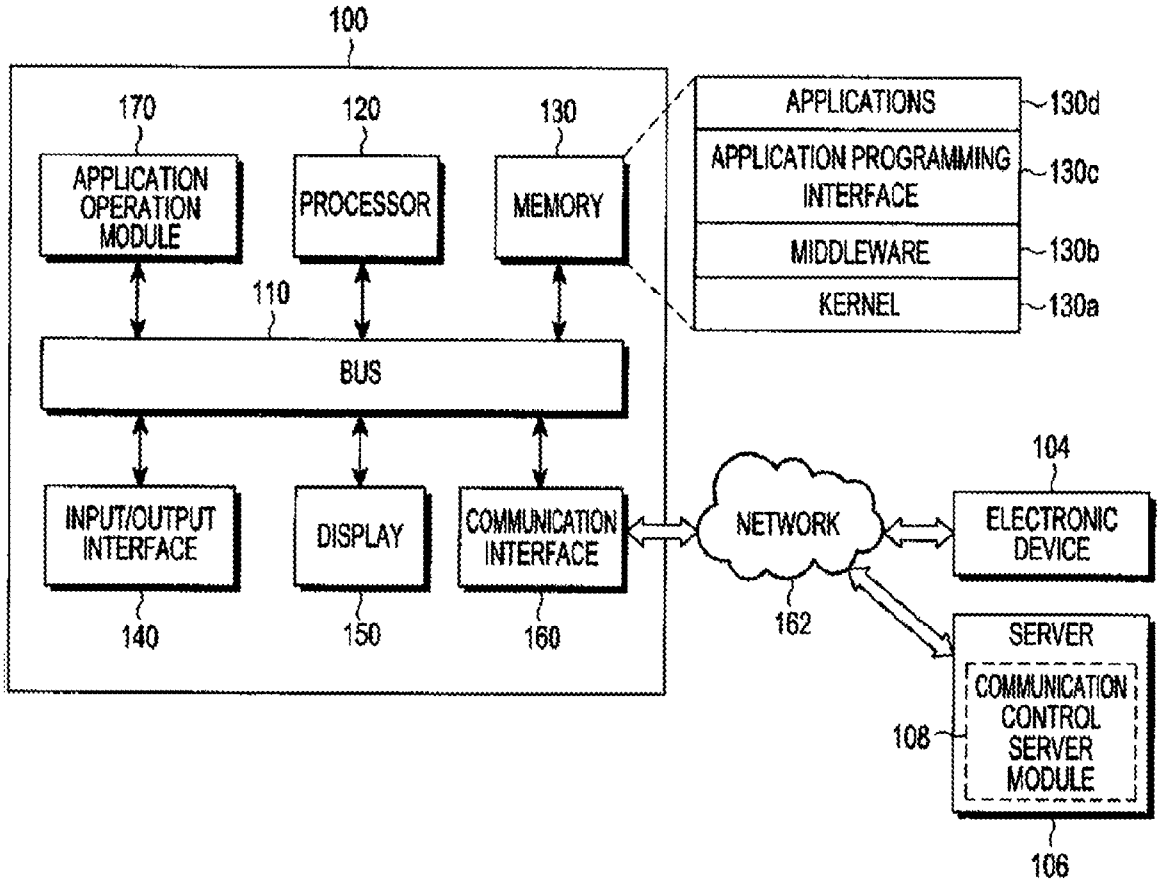


Fig. 18 Prior Art

Table 1
Upper-Airway Obstruction During Seizures

Respiratory Parameter	Difference Score (Seizure Minus Pre-Seizure)		
	Non-Intubated (*N* = 11)	Intubated (*N* = 5)	*p*-Value
Respiratory Rate (min^{-1})	286 ± 56	196 ± 37	0.017
Tidal Volume (ml)	-1.05 ± 0.37	-0.51 ± 0.50	0.12
Minute Ventilation ($ml \cdot min^{-1}$)	-24 ± 40	-2 ± 40	0.65
Peak-Inspiratory-Flow to Peak-Expiratory-Flow Ratio	-0.51 ± 0.31	0.54 ± 0.41	0.002

Fig. 19

Table 2

COMPARISON OF CONSEQUENCES OF OBSTRUCTIVE AND CENTRAL APNEA

	obstructive apnea		p	central apnea		p (df, t)
	non-intubated	intubated		non-intubated	intubated	
rats with apneic periods ≥ 1 s (total N)	7 (11)	0 (5)	***0.034***	6 (11)	5 (5)	NS
number of apneic periods	7			31	18	
duration	103.3 ± 42.2			7.3 ± 5.7	7.4 ± 10.6	NS
rats with apneic periods > 5 s	7	0		5	1	NS
number of apneic periods	7			15	5	
duration	103.3 ± 42.2			12.1 ± 4.4	21.0 ± 12.5	NS
maximum duration	162			23	33	
mean HR (pre-apnea) bps	3.8 ± 0.4			4.1 ± 0.5 (pooled)		NS
mean HR (apnea @ 5-15 s) bps	3.1 ± 0.6 (***p=0.036; df=6; t=2.7***)			3.8 ± 0.7 (NS)		***0.025 (14, 2.5)***
minimum HR (apnea @ 5-15 s) bps	2.6 ± 0.5 (***p=0.005; df=6; t=4.4***)			3.6 ± 0.7 (***p=0.023; df=8; t=2.8***)		***0.002 (14, 3.9)***
ST changes within 15 s?	yes			no		
max % change (mean +/- SEM)	-31.4 ± 17.3, n=7			-13.9 ± 9.7, n=9		***0.019 (14, 2.6)***

Fig. 20

Table 3

	kainic acid only lesion, then kainic acid			bilateral SLN lesion, then kainic acid					intubated, then kainic acid					group by group seizure		
	baseline	seizure	b:s	baseline	SLN seizure	b:l	l:s		baseline	intubated	seizure	b:i	i:s	Int:SLN	Int:KA	KA:SLN
number of animals in the group	5			6					5							
average number respiratory cycles per rat per group	439.8	1244.8		402.0	402.0	1418.6			426.4	452.0	1100.6					
respiratory rate (breaths/min)	89.0	370.9	**0***	81.8	80.8	370.7	NS	**0**	100.2	98.3	294.8	NS	**0**	NS	NS	NS
average tidal volume (ml)	1.24	0.46	**0.008**	1.77	1.72	0.46	NS	**0**	1.25	1.04	0.53	NS	NS	NS	NS	NS
minute ventilation (ml/min)	108.0	94.4	NS	144.6	138.8	106.1	NS	**0**	124.2	95.3	93.3	NS	NS	NS	NS	NS
peak inspiratory flow / peak expiratory flow	0.95	0.60	NS	1.18	1.11	0.46	NS	**0.001**	1.13	1.02	1.56	NS	**0.011**	**0**	**0**	NS
peak inspiratory flow (ml/s)	-6.82	-5.34	NS	-8.62	-8.64	-6.02	NS	**0.002**	-6.83	-5.79	-5.43	NS	NS	NS	NS	NS
peak expiratory flow (ml/s)	7.56	5.24	NS	7.75	8.12	5.65	NS	NS	6.03	6.00	4.81	NS	NS	NS	NS	NS
duration of inspiration (s)	0.36	0.11	**0.001**	0.35	0.37	0.10	NS	**0**	0.27	0.32	0.12	NS	**0.003**	NS	NS	NS
duration of expiration (s)	0.33	0.13	**0**	0.39	0.38	0.12	NS	**0**	0.34	0.31	0.16	NS	**0**	**0.046**	NS	NS
inspiratory tidal volume (ml)	-1.24	-0.46	**0.008**	-1.77	-1.72	-0.46	NS	**0**	-1.26	-1.04	-0.53	NS	NS	NS	NS	NS
expiratory tidal volume (ml)	1.24	0.46	**0.008**	1.77	1.72	0.46	NS	**0**	1.25	1.04	0.53	NS	NS	NS	NS	NS
time when 25% of tidal volume has been inspired (s)	0.17	0.04	**0.035**	0.13	0.15	0.03	NS	**0.004**	0.09	0.15	0.04	NS	**0.041**	NS	NS	NS
time when 50% of tidal volume has been inspired (s)	0.22	0.06	**0.011**	0.19	0.21	0.05	NS	**0.001**	0.14	0.20	0.07	NS	**0.016**	NS	NS	NS
time when 75% of tidal volume has been inspired (s)	0.27	0.08	**0.003**	0.25	0.27	0.07	NS	**0**	0.19	0.24	0.09	NS	**0.007**	NS	NS	NS
time when 25% of tidal volume has been expired (s)	0.07	0.03	**0.012**	0.09	0.09	0.03	NS	**0**	0.07	0.07	0.04	NS	**0**	NS	NS	NS

Fig. 21

time when 50% of tidal volume has been expired (s)	0.12	0.05	**0.014**	0.16	0.16	0.05	NS	**0**	0.13	0.11	0.06	NS	**0**	**0.046**	NS	NS
time when 75% of tidal volume has been expired (s)	0.18	0.07	**0.016**	0.25	0.24	0.07	NS	**0**	0.20	0.17	0.09	NS	**0**	**0.041**	NS	NS
flow when 25% of tidal volume has been inspired (ml/s)	-6.04	-4.46	NS	-6.93	-6.74	-5.02	NS	NS	-6.09	-4.68	-4.48	NS	NS	NS	NS	NS
flow when 50% of tidal volume has been inspired (ml/s)	-6.09	-5.12	NS	-7.90	-7.99	-5.77	NS	**0.009**	-6.40	-5.43	-5.22	NS	NS	NS	NS	NS
flow when 75% of tidal volume has been inspired (ml/s)	-5.31	-4.76	NS	-7.03	-6.88	-5.21	NS	**0.007**	-5.69	-4.94	-4.91	NS	NS	NS	NS	NS
flow when 25% of tidal volume has been expired (ml/s)	7.38	4.95	NS	6.70	6.60	5.21	NS	NS	5.84	5.77	4.58	NS	NS	NS	NS	NS
flow when 50% of tidal volume has been expired (ml/s)	6.47	4.92	NS	6.61	6.30	5.36	NS	NS	5.11	5.27	4.43	NS	NS	NS	NS	NS
flow when 75% of tidal volume has been expired (ml/s)	4.65	3.65	NS	4.91	4.94	4.15	NS	NS	3.90	3.67	3.32	NS	NS	NS	NS	NS
* a "0" indicates p<0.0001																

Fig 21 Continued