20,21 EFFECTS OF THE LUNG IMPEDANCE AND BIAS FLOW ON TRIGGERING WORK OF BREATHING DURING PRESSURE SUPPORT VENTILATION.

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We have calculated triggering work of breathing (WOB_{tr}) during PSV using a spring-loaded bellows type lung model with an adjustable impedance. We investigated the effect of bias flow on WOB_{tr}, delay time and V_T. The inspiratory efforts (P_{jet}) and resultant volume displacement of diaphragm bellows (V_{Tjet}) were provided by a jet-flow generator. We calculated WOB_{tr} as the area surrounded by the P_{jet}-V_{Tjet} curve and V_{Tjet} during the triggering delay. A Puritan-Bennett 7200a ventilator was used in the CPAP mode at a different PS levels. Sensitivity was 2 cmH_2O. To evaluate a bias flow effect on breathing pattern during PSV a variable bias flow (0 to 20 L/min) was delivered by a Newport Wave ventilator (NMI, USA).

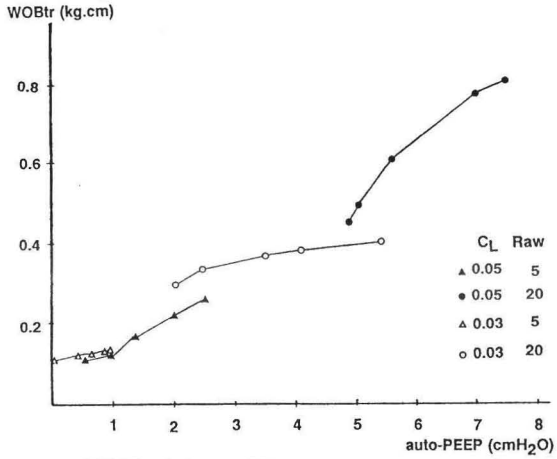
WOB_{tr} depended on the auto-PEEP levels, as it is shown in Fig. Regardless of lung impedance, WOB_{tr} was proportionally increased with auto-PEEP levels for a given PS level. The maximal WOB_{tr} was obtained at the maximal auto-PEEP level being caused by the longest time constant settings.

The bias-flow increased both the delay time and WOB_{tr}, and decreased both the pressure supporting time and V_T (TABLE).

TABLE. WOB_{tr}, time delay and V_T at various bias-flow rates and pressure support levels.

Pressure Support Level-5cmH_2O						
Bias-Flow(L/min)	0	2	5	10	15	20
T Delay(msec)	70	150	160	180	210	340
V_T(ml)	550	540	530	520	490	390
WOB_{tr}(kg.cm)	.2	0.6	0.8	1.1	1.4	5.6
Pressure Support Level-15cmH_2O						
Bias-Flow(L/min)	0	2	5	10	15	20
T Delay(msec)	80	160	170	180	210	300
V_T(ml)	690	660	640	630	620	430
WOB_{tr}(kg.cm)	0.3	0.6	0.8	1.0	1.6	5.7

The presence of auto-PEEP implied that for triggering the ventilator the inspiratory muscles must generate an additional force. Greater WOB_{tr} required to overcome the opposing positive pressure developed in alveoli.



With bias flow system continuous flow rate was always presented to act as a calibration baseline for the sensor used to trigger the ventilator. The increase in flow rate resulted in the decrease in sensitivity with increasing delay time and WOB_{tr}. Our method proved, that bias flow system misconceptionally incorporated in some ventilators.

In conclusion, using the lung model, we have developed the method to determine quantitatively WOB_{tr}. With this method, we could clarify the relationship between WOB_{tr} and auto-PEEP which was mostly caused by the high airway resistance. The bias flow increased triggering delay and WOB_{tr} and could not be recommended during PSV.