TITLE: PEEP VALVES MAY DOOM PRESSURE CONTROL INVERSE-RATIO VENTILATION

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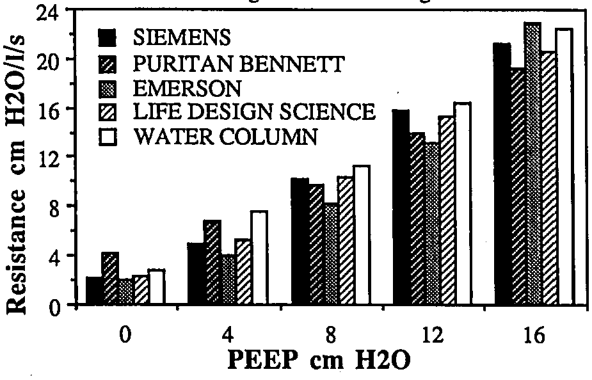
In patients on pressure control inverse-ratio ventilation (PCIRV), time for expiration is short compared with the one needed for complete exhalation. Thus air trapping will occur. Intrathoracic pressure at the end of passive expiration does not reach zero and is called intrinsic PEEP (PEEPi). Three factors determine the amount of PEEPi: 1) thoracic compliance, 2) total expiratory resistance (patient + system), 3) expiratory time. System resistance may be substantial with PEEP devices, especially at high PEEP values.

Compliance and resistance of a test lung were adjusted to representative values of ARDS patients. The ventilator was set at a rate and ratio to produce air trapping. Five types of passive PEEP devices were tested at 0, 4, 8, 12, 16 cmH2O PEEP settings : Scissor (Siemens), mushroom (Puritan Bennett), spring loaded (Life Design Science) valves, closed water column (Emerson), open water column (tube submerged in water). At each level of PEEP, resistance as a function of time was determined 10 times by dividing the pressure drop across the device by the corresponding flow. Differential pressure and flow were sampled at 100 Hz during exhalation. The flow and pressure transducers had a frequency response from 0-10 Hz and no phase shift between them. A mean resistance over the mid 50% expired volume is reported for comparability.

As shown in the figure there was a significant increase in resistance with PEEP setting. There was no significant difference



in the resistance between the various PEEP devices, in contrast to reported PEEP valve performances in high flow CPAP settings [1]. Especially in PCIRV, air trapping increases as system resistance increases. Any of the tested PEEP devices may cause a rise in PEEPi, promoting the development of ventilatory failure and barotrauma during PCIRV. Regulation of PEEPi without adding PEEP devices would be preferable.

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TITLE: THE STRESS OF SPONTANEOUS BREATHING IN CHILDREN RECOVERING FROM OPEN HEART SURGERY

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The effects of withdrawal of ventilatory support on cardiorespiratory function, oxygen consumption, and carbon dioxide production were assessed in 30 children recovering from open heart surgery to evaluate the cardiocirculatory stress of spontaneous respiratory work.

The study was performed within 2.7±2.4 days (mean±SD) of the operation, at a time when adequate spontaneous ventilation could be expected on the basis of clinical evaluation of the patient. Assessment of cardiorespiratory function and indirect calorimetry were performed during controlled mechanical ventilation (CMV) and during spontaneous breathing with continuous positive airway pressure (CPAP). The data were analyzed using a repeated-measures analysis of variance.

Withdrawal of mechanical ventilatory support resulted in reversal of hypocapnia observed during CMV, while oxygenation of arterial blood remained unchanged (Table). Initiation of spontaenous breathing was not associated with significant change in oxygen consumption or carbon dioxide production. Increased blood pressure and central venous oxyhemoglobin saturation indicated improved systemic blood flow upon withdrawal of positive pressure ventilation.

	CMV	CPAP	p
SaO2 (%)	97±2	97±2	NS
ScvO2 (%)	68±11	74±9	<0.01
PaCO2 (mmHg)	33±5	38±4	<0.01
pHa	7.43±0.09	7.37±0.05	<0.01
Heart rate (bpm)	125±17	130±17	NS
Blood pressure (mmHg)	63±8	66±7	<0.05
VO2 (ml·kg-1·min-1)	7.8±1.8	7.8±1.7	NS
VCO2 (ml·kg-1·min-1)	6.1±1.3	6.0±1.2	NS

Cardiocirculatory stress associated with spontaneous breathing is minimal in a clinically stable child recovering from open heart surgery. Withdrawal of positive pressure ventilatory support is likely to improve cardiac output and tissue oxygen availability in such patients.