

POSTER PRESENTATION

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0989. Accuracy of delivered airway pressure during proportional assist ventilation +. A bench study

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Introduction

Proportional assist ventilation (PAV+) is a partial ventilatory support mode delivering airway pressure (Paw) in proportion to patient effort, enhancing patient-ventilator interactions. The ventilator estimates muscular pressure by using the respiratory system equation of motion with the instantaneous volume (V) and flow (V') and the automatically calculated compliance and resistance. The mode gains in popularity but the accuracy of the delivered Paw by PAV+ is unknown.

Objectives

To assess the accuracy of PAV+ by comparing the delivered Paw by the ventilator (Paw_{meas}) to the theoretical Paw as defined by the equation of motion (Paw_{Th}) and to examine the factors influencing this accuracy.

Methods

An active servo lung (ASL5000) was programmed to resemble 4 respiratory mechanics: normal (Compliance (C) = 60mL/cmH₂O, Resistance (R) = 10cmH₂O/L/sec), obstructive (C = 60, R = 20), restrictive (C = 30, R = 10), and mixed (C = 30, R = 20). A Puritan-Bennett 840 ventilator with PAV+ was used. PAV+ was tested varying gain (30 and 60%), inspiratory trigger (IT) (0.8, 5 and 15 L/min), muscular pressure (P_{mus}) (10 and 15 cmH₂O), positive end-expiratory pressure (PEEP) (0 and 5 cmH₂O), and respiratory rate (RR) (10 to 30/min) to simulate intrinsic PEEP (PEEP_i). PEEP_i was measured using the P_{mus} curve. Paw_{Th} was calculated as follows: Paw_{Th} = [(V/C)+(R×V')] × Gain + total PEEP.

The inspiratory time was defined from the start of P_{mus} to the end of inspiratory V'. We calculated the difference between the mean Paw_{meas} and the mean Paw_{Th} during inspiration and between Paw_{meas} and Paw_{Th} at 25, 50, 75 and 100% of the inspiratory time. The percentage of difference between Paw_{meas} and Paw_{Th} was calculated as follows: %Δ = (Paw_{meas}-Paw_{Th})/Paw_{Th} × 100.

Results

Irrespective of respiratory mechanics and gain, mean Paw_{meas} was lower than mean Paw_{Th}, Table1.

This underassistance by the ventilator was greatest at the beginning (25%) of the cycle and decreased later (75%) in inspiration. These findings were replicated under different IT, P_{mus} or PEEP settings. A high IT led to greater underassistance at the end of inspiration versus a low IT. A high P_{mus} was associated with a greater underassistance during the entire inspiration versus a low P_{mus}. A decrease in PEEP was associated with a major underassistance at the start of the inspiration. A higher RR resulted in a higher %Δ, showing that PEEP_i increases total trigger delay and affects PAV+ accuracy, fig. 1. Combining the data from all conditions, PEEP_i was correlated with the mean %Δ (R² = 0.61, p < 0.001).

Conclusions

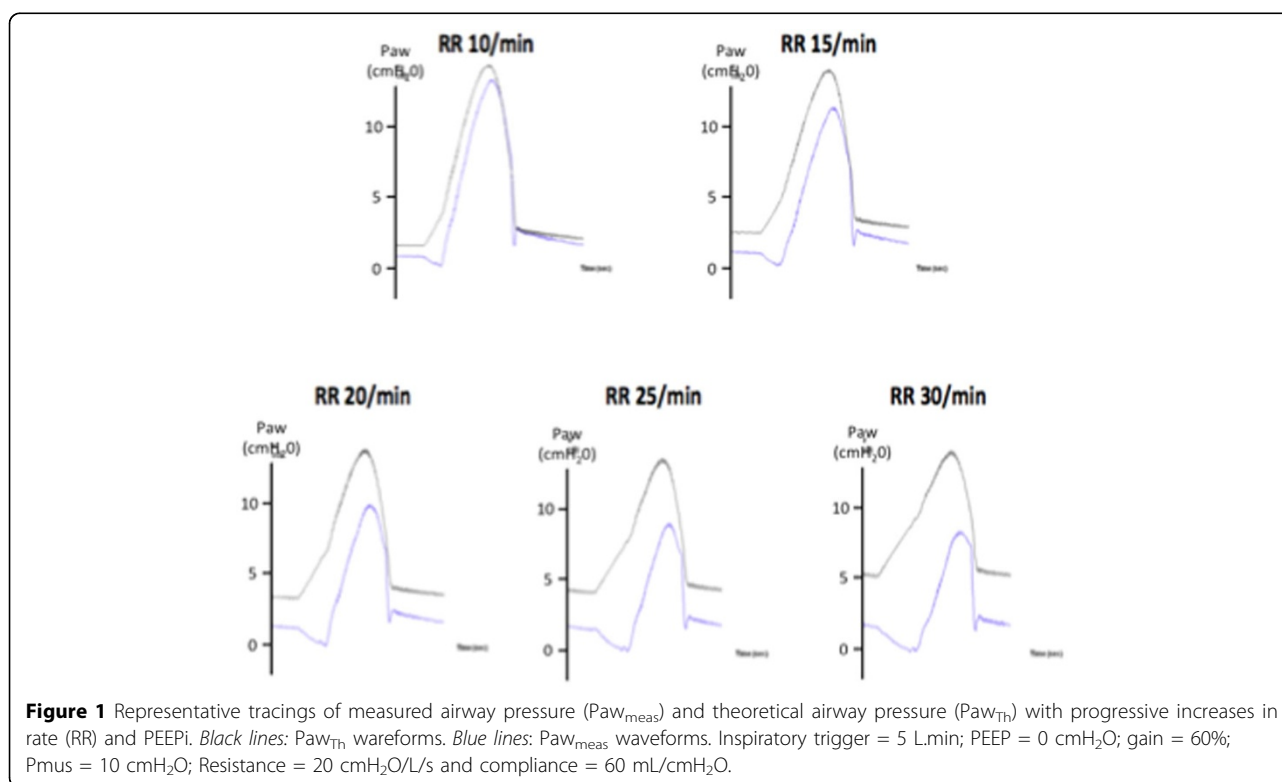
PAV+ assistance is globally accurate compared to Paw_{Th} even if underassistance is often observed, especially at the start of inspiration. PEEP_i leading to increased trigger delay is a major factor contributing to PAV+ inaccuracy. Clinical recommendations should include using a high trigger sensitivity and a careful PEEP titration when PEEP_i is suspected.

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Table 1

Gain (%)	Mechanics	Mean Pawmeas (cm H2O)	Mean PawTh (cm H2O)	Difference mean Pawmeas - mean PawTh (cm H2O)	mean Δ% (%)
30	Normal	6.6	9.4	-2.8	-29.8
	Obstructive	8.4	10.8	-2.4	-22.2
	Restrictive	7.0	8.5	-1.5	-17.6
	Mixed	6.7	8.8	-2.1	-23.9
60	Normal	9.6	13.7	-4.2	-29.9
	Obstructive	9.5	13.6	-4.1	-30.1
	Restrictive	10.2	13.0	-2.8	-21.5
	Mixed	10.3	13.5	-3.2	-23.7
All conditions		8.5	11.4	-2.9	-25.4



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