

HAMILTON · P/V TOOL®

Intelligent Ventilation



Recruitability and PEEP - in a safe and simple way

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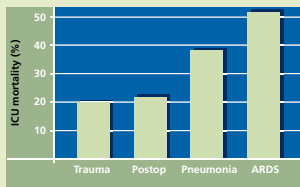
In the acute respiratory distress syndrome (ARDS) as well as in acute lung injury (ALI), positive end-expiratory pressure (PEEP) may decrease ventilator-induced lung injury by keeping lung regions open that otherwise would be collapsed.

However, the ability of the lung regions to become and remain open, i. e. "recruitability", is a prerequisite for a rational determination of the levels of PEEP to be applied.

The conservative method to estimate recruitability uses the CT scan and PEEP induced changes in physiologic respiratory variables.

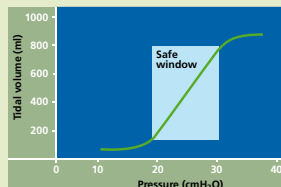
Whereas the transport to the CT for strongly injured patients is difficult, the PEEP induced changes in physiologic respiratory variables give only a weak estimation for recruitability.

With the P/V-Tool Recruitability and PEEP level estimation becomes easy for the operator and safe for the patient.



High incidence and high mortality

The incidence of ALI/ARDS is high. Every year in the USA, more than 220,000 cases are reported¹⁾ and result in considerable ICU mortality²⁾.



Nonprotective ventilation may be harmful

In ALI/ARDS patients, mechanical ventilation by itself may induce lung and systemic injuries if positive end expiratory pressure (PEEP) and tidal volume are not correctly set. Conversely, appropriate PEEP and tidal volume settings may improve the outcome for these patients^{3) 4) 5) 6)}.

References: **1)** Ware LB, Matthay MA. The acute respiratory distress syndrome. *N Engl J Med.* 2000 May 4;342(18):1334-49. **2)** Esteban A, Anzueto A, Frutos F, Alia I, Brochard L, Stewart TE et al. Characteristics and outcomes in adult patients receiving mechanical ventilation. A 28-day international study. *JAMA.* 2002;287(3):345-55. **3)** Ranieri VM, Giunta F, Suter PM, Slutsky AS. Mechanical ventilation as a mediator of multisystem organ failure in acute respiratory distress syndrome. *JAMA.* 2000;284:43-44. **4)** Ranieri VM, Suter PM, Tortorella C, De Tullio R, Dayer JM, Brienza A et al. Effect of mechanical ventilation on inflammatory mediators in patients with acute respiratory distress syndrome: a randomized controlled trial. *JAMA.* 1999;282:54-61. **5)** Amato MB, Barbas CS, Medeiros DM, Magaldi RB, Schettino GP, Lorenzi-Filho G et al. Effect of a protective-ventilation strategy on mortality in the acute respiratory distress syndrome. *N Engl J Med.* 1998;338:347-54. **6)** The Acute Respiratory Distress Syndrome Network. Ventilation with lower tidal volumes as compared with traditional tidal volumes for acute lung injury and the acute respiratory distress syndrome. *N Engl J Med.* 2000;342:1301-8. **7)** Servillo G, De Robertis E, Coppola M, Blasi F, Rossano F, Tufano R. Application of a computerised method to measure static pressure volume curve in acute respiratory distress syndrome. *Intensive Care Med.* 2000;26:11-14. **8)** Jonson B, Richard JC, Straus C, Mancebo J, Lemaire F, Brochard L. Pressure-volume curves and compliance in acute lung injury: evidence of recruitment above the lower inflection point. *Am J Respir Crit Care Med.* 1999;159:1172-78. **9)** Tobin MJ. Advances in mechanical ventilation. *N Engl J Med.* 2001;344:1986-96. **10)** Hickling KG. Best compliance during a decremental, but not incremental, positive end-expiratory pressure trial is related to open-lung positive end-expiratory pressure: a mathematical model of acute respiratory distress syndrome lungs. *Am J Respir Crit Care Med.* 2001;163:69-78. **11)** Hickling KG. The pressure-volume curve is greatly modified by recruitment. A mathematical model of ARDS lungs. *Am J Respir Crit Care Med.* 1998;158:194-202.

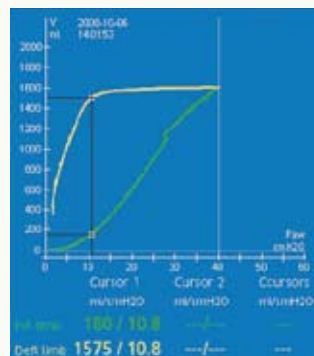
How it works

The P/V Tool on the HAMILTON-G5 offers a fully-automatic maneuver that records the static pressure-volume curve quickly and easily at the bedside.

The tool employs an adjustable pressure ramp, in which airway pressure is slowly increased and decreased as flow and pressure are recorded.

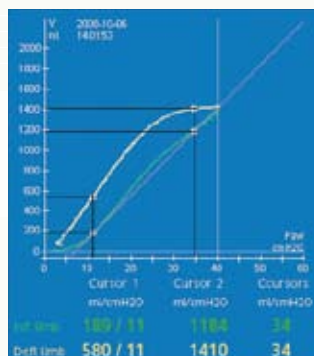
After the curve is frozen, the inflation and deflation curve is analyzed using the semi-automatic cursors to determine hysteresis, upper and lower inflection points.

Recruitment-Maneuver

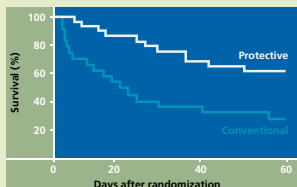


If the hysteresis between inflation and deflation curve is important enough, a recruitment maneuver becomes reasonable. The frozen PV-curve and the cursor facilitate to evaluate the PEEP.

Set PEEP



If the hysteresis between inflation and deflation curve is too narrow, a durable recruitment of the lung is not possible. In this case – over the PV-curve and the cursor – the lower inflection point can be evaluated to determine the appropriate PEEP to set.



Protective ventilation may improve survival
Using the pressure/volume (P/V) curve to set PEEP and tidal volume was associated with a 46% reduction in the mortality rate of severe ARDS patients ⁹⁾.

HAMILTON · P/V TOOL®

The P/V Tool is particularly advantageous to hard-to-ventilate patients suffering from acute lung conditions (ALI/ARDS).

The P/V Tool requires no disconnection of the breathing circuit, and no changes to ventilation settings.

The P/V Tool allows you to resume normal ventilation at any time.

The P/V Tool gives you a simple and safe way to perform lung recruitment maneuvers.

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Available in HAMILTON-G5 and Galileo.



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