

APOLLO VS. FABIUS COMPARISON IN LUNG MODELS SHOWS A DIFFERENCE

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Introduction: Anesthetic ventilators are vital to the safe administration of inhalational anesthetics. There are different models of ventilators with unique features which may be important for optimizing mechanical ventilation in pediatric and adult surgical patients with obstructive or restrictive lung disease while preventing hypoxemia, hypercarbia, and/or barotrauma. This study contrasts two types of anesthesia machine ventilators: The Apollo and Fabius GS. The relative position of the anesthesia bag in the circle system of the Apollo lowers the airway resistance compared with the Fabius (1). Two lung models were used with each machine for comparison. The first lung model (A), an anesthesia bag, represented an ordinary lung. The second lung model (R), an anesthesia bag with resistance, represented an obstructed and/or restrictive lung pattern.

Methods: The two lung models were contrasted using Pressure Limited Volume Control (VC) mode, and Pressure Control (PC) mode using graduated independent variable titration and measurement of dependent variables for both the Apollo and Fabius anesthesia machines. Slope analysis (least squares method) was performed on the linear portion of the ventilation curves. Dynamic compliance $Cd = (TV)/(P_{peak})$ was measured.

Results: In volume mode, lung model A is more compliant than lung model R. The Apollo has more compliance than the Fabius, especially in lung model R. In pressure mode, the Apollo A (TV = 1109.8 mL) and Fabius A (TV = 910.6 mL) demonstrated a 199.2 difference between the means of the two independent samples. This represents a 5.0 difference in dynamic compliance (27.8 vs. 22.8). In volume mode, the Apollo R (Peak = 29 cm H₂O, TV = 433.2 mL) and Fabius R (Peak = 32 cm H₂O), TV = 404 mL) demonstrated a 29.2 difference between the means of two independent samples at set tidal volume = 500 mL. This represents a 2.3 difference in dynamic compliance (14.9 vs. 12.6).

Average Dynamic Compliance		
Mean ± SEM	Pressure Mode	Volume Mode
Apollo	20.9 ± 0.80	17.1 ± 0.32
Fabius	17.9 ± 0.81	15.9 ± 0.52

In pressure mode, lung model A has more compliance than lung model R. The Apollo has more compliance than the Fabius, especially in lung model A. Apollo has more dynamic compliance than the Fabius across all pressures and volumes in both lung models.

Summary: Our data suggests that there is reduced mean airway pressure and improved dynamic compliance with the Apollo compared to the Fabius. This may be due to the increased resistance from the Fabius machine. Pressure mode seems to have increased dynamic compliance compared with the volume mode. Our results suggest that patients with ARDS may benefit from the features of the Apollo over the Fabius based on the fact that the arrangement of the circuit requires higher mean airway pressures in the Fabius.

References:

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