

# Mechanical properties of the patient circuit and its analogous model

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## Introduction

High-frequency oscillatory ventilation (HFOV) is novel type of artificial lung ventilation characterized by low tidal volume and high ventilatory frequency compared with conventional mechanical ventilation. Obstruction diseases like asthma or chronic obstruction pulmonary disease are supposed to be contraindications for HFOV. Mechanical properties of the patient circuit and its parts are studied to design the model of the patient circuit.

## Methods

We have measured pressure loss of the ventilatory parts during different levels of flow. The pressure loss was measured for constant flow and for oscillating flow generated by a driven valve. A volume of the air was applied to the circuit and its compliance was computed from the change of the pressure. The parameters based on the measurement are compared with the theoretical models.

## Results

The resistance of the ventilatory parts is flow dependent and also the shape of the tubes has a significant effect on its value. The mechanical properties received by measuring and computations are compared with those from theoretical models that are often used in literature. Reynolds number is significantly higher than 2000 for high flows that occur during HFOV and it is necessary to consider turbulent flow.

## Conclusion

Patient circuit with endotracheal tube substantially contributes to the resistance of the respiratory system. It can affect intrapulmonary parameters and efficiency of artificial lung ventilation mainly during obstructive pulmonary diseases. Also the compliance and inertance of the patient circuit should be considered when modelling the use of HFOV.

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