PRESSURE FLOW PATTERN AND GAS TRANSPORT USING VARIOUS TYPES OF HIGH FREQUENCY VENTILATION

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1. Different High Frequency Ventilation (HFV) systems have been described so far. Common to all methods are frequencies far above normal respiratory rates combined with tidal volumes in the range of the anatomic dead space of the lungs. However, the gas transport mechanisms involved are not yet quite clear and may well be of different nature for each HFV system. One way to improve our understanding are measurements on physical models of the lungs which allow comparisons between the different methods. In the first instance pressure, flow and volume conditions can be derived from such models. For a more detail description of the processes a visualisation of flow profiles and local velocities in the bronchial system seems to be useful. Gastransport efficiency can be determined by the partial pressure gradiance along the conductive airways in a steady state lung model. Some of the results from this experimental measurements with 4 different HFV-systems are discussed.

2. Lung model for pressure flow measurements (Fig.1)
It consists of a glass flask of 50 or 25 1 respectively which represents the compliant element. The flask can be intubated via a 20 mm pipe with common cuffed tracheal tubs. A hot wire flow sensor is built into this pipe measuring the total flow in and out the compliant element. An additional changeable flow resistance allows adjustment of different lung impedances. Pressure lines for tracheal (Ptr) and pleural (Ppl) pressure measurements are provided. A further pipe normally closed allows simulation of a leaking lung.
3. Results of pressure flow measurements.
3.1. High frequency pulsation (HFP) fig.2
Our HFP-system basically consists of a T-piece attached to the tracheal tube with a 1.5 mm bore on top. This nozzle is connected to a solenoid valve which interrupts the flow coming from an adjustable high pressure source. The T-piece has a 9 mm neck where the jet spreads and produces positive pressure pulses. An additional fresh gas flow of 10 l/min and a dead space tube on the opposite side is necessary to avoid the entrainment of room air during inspiration. Original records of the entrance pressure at the tube (Pentr.), the flow to and from the lungs (VL) and the pressure at alveolar level are given. In addition the cross flow (Vcross) in the dead space tube was measured with a Fleisch-tube. The two most important findings are: 1. Only a small portion of the pressure swing is transmitted to the alveolar space, but mean pressure is high because