



Portable instrument for the volume measurement of high-frequency percussive ventilators - biomed 2010.

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In recent years, the usefulness of High Frequency Percussive Ventilation (HFPV) has been clinically valued as a suitable alternative to conventional mechanical ventilation especially in particularly conditions (for example in pulmonary resection [1]). However, sophisticated and expensive equipments are required for measuring the respiratory parameters during HFPV, because of the fast flow variation requiring output conditioning of the standard transducers with a complicated and expensive apparatus. In this paper, a compact, portable and inexpensive innovative system for the volume measurement during HFPV is described. The system uses pressure transducers of new generation with high sensitivity (up to 0.25 inches of water) and reduced response time (0.5 milliseconds). It acquires the flow with a sampling rate of 2 KHz, computes the volume every 64 samples by numerical integration and sends the values to a visualization device (Hewlett Packard HP50g) that updates the numerical value and the volume plot every 32 milliseconds. In order to verify the device reliability, a test system was produced. The output of a Percussionaire (VDR-4) was connected to a lung-simulator and the pressure and flow measures were carried out both by means of a laboratory measurement system of respiratory parameters (V_{T+}) and of our portable device. The results show that the sampling frequency of the V_{T+} (50 Hz) is insufficient in the case of percussive ventilation, producing unacceptable errors (about 20%) in the volume evaluation; on the contrary, the sampling frequency of our system (2 KHz) allows to gain correct results. In conclusion, the suitable sampling frequency together with the system portability allow our device to realize a precise monitoring of respiratory parameters, during HFPV, of patients in surgery room or in intensive care unit.

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