

***In vitro* investigations of jet-pulses for the measurement of respiratory impedance in newborns**

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In vitro investigations of jet-pulses for the measurement of respiratory impedance in newborns. M. Schmidt, B. Foitzik, O. Hochmuth, G. Schmalisch. ©ERS Journals Ltd 1999.

ABSTRACT: The aim of this *in vitro* study was to investigate the measuring range and accuracy of a miniaturized equipment for respiratory impedance (Z_{rs}) measurements in newborns using jet-pulses.

Brief flow pulses (peak flow=16 L·min⁻¹, width=10 ms) were generated by a jet-generator consisting of a solenoid valve and an injector, situated between pneumotachograph and outflow resistance. Serially arranged resistance-inertance-compliance ($R-I-C$) lung models ($RM=1.3-6.4$ kPa·L⁻¹·s, $CM=7.4-36.9$ mL·kPa⁻¹, $IM=1.5$ Pa·L⁻¹·s²) were used to measure the real and imaginary part of Z_{rs} between 4 and 50 Hz and to determine R , C and I by means of the method of least squares.

The median errors for R , C and I were -0.1 kPa·L⁻¹·s (-2%), 2.4 mL·kPa⁻¹ (13%) and -0.2 Pa·L⁻¹·s² (-13%) for measurements without breathing signals and 0.11 kPa·L⁻¹·s (3%), 3 mL·kPa⁻¹ (16%) and 0.28 Pa·L⁻¹·s² (19%) in mechanically ventilated models. During spontaneous breathing the influence of the breathing flow on Z_{rs} was negligible. The equipment did not show any nonlinearity when different pulse amplitudes were used ($V_{max}=13-22$ L·min⁻¹).

The investigations have shown that jet-pulses allow reliable measurements of respiratory impedance and have the potential to provide valuable information about lung mechanics in spontaneously breathing and mechanically ventilated newborns. The developed measuring head has a low apparatus dead space, is easy to disinfect, has standard connections and can be used as the T-piece in a ventilator circuit.

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