HOW RELIABLE IS AUTOMATIC OR MANUAL CALCULATION OF LUNG COMPLIANCE USING VENTILATOR READOUTS ? A MODEL STUDY

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Background and aims: Modern ventilators offer different tools for manual/automatic compliance (C) calculation, using measurement of pressure (PIP/PEEP) and tidal volume (Vt), but impact of varying ventilator settings and methodological limitations are not established.

To compare in a model study 4 different methods of C measurement: dynamic C (Cdyn), C calculated by the Mead-Whittenberger method (Cwitt), C calculated at quasistatic conditions (inflation hold (PIP) of 30 mbar(C-IH)), static C (Cstat) as gold standard.

Methods: Ventilation of 3 models of newborn lungs, representing different pressure/volume characteristics, with Dräger Babylog 8000plus. Study of varying combinations of ventilator settings, recording of: Cwitt as displayed by the ventilator; Cdyn calculated from Vt/(PIP-PEEP); C-IH calculated as Vt/30mbar, Cstat measured with Sensormedis2600. Statistics: Mean and standard deviation; Pearson linear regression; Kruskall-Wallis test.

Results: Unreliable results obtained with low ti and/or te. Analysis of pooled data: Cwitt higher, Cdyn lower than Cstat (both $p < 0.05$); at comparable settings (PIP 30mbar) tendency of C-IH to be lower and of Cwitt to be higher than Cstat; increasing deviation with increasing model lung C (C-IH/Cwitt: lung1 +1.6/-3.2%; lung2 +4.4/-3.4%; lung3 +6.8/-6.0%). Best correlation between C-IH and Cstat ($r^2=0.998$). Discrepancy results from underestimation of Vt (29.3%-43.2 % for the 3 models ($p < 0.05$)).

Conclusions: C-IH was superior to Cdyn and Cwitt and close to the standard Cstat. An important reason for deviation was underestimation of Vt by the Babylog. With short ti/te inaccuracy of pressure measurement may also be important. C-IH offers a good tool for bedside calculation of C.