ELECTRONIC SUPPLEMENTARY MATERIAL

Neonatal and Adult ICU ventilators to provide ventilation in neonates, infants and children: a bench model study

Authors

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Methods

Ventilators

Main characteristics of the tested ventilators are summarized in table 1.

Measured parameters (figure 2, main article)

The tracing analysis allowed determination of several key parameters of pressure supported breaths, namely:

- Triggering (trigger delay (Td)): time lag between the onset of inspiratory effort and the beginning of pressurization; auto-triggering: an evaluation was made over the two minutes of each recording at each of the test conditions.
- Pressurization (pressure-time products at 300 ms (PTP300)): for each respiratory cycle PTP300 was computed as the area under the time-pressure curve between the onset of inspiratory effort and 300 ms. This parameter reflects trigger delay, the speed of pressurization and the ventilator capacity to maintain the set pressure during inspiratory effort. PTP300 is expressed as a percentage of the ideal time-pressure product, as shown in figure 2. The ideal PTP (100%) cannot be obtained, since it would imply a Td of zero and instantaneous pressurization by the machine. Nonetheless, the closer the value of PTP300 is to 100%, the higher the device pressurization capacity.
- Cycling (inspiratory time in excess (tiex)): the duration of pressurization by the ventilator (tiv) is compared to the actual time of the mimicked patient, i.e the duration of inspiration set on the driving ventilator (tip) in the following manner: the duration of pressurization by the ventilator in excess (positive value) or in deficit (negative value) of the tip (tiex) was directly measured on the tracing, and expressed as a % of tip: tiex = (tiv-tip)/ tip) x 100. A positive tiex indicates delayed cycling while a negative tiex reflects premature cycling.
- Tidal volumes measured by the machine and really delivered to the patient measured by integration of the flow curve. For neonatal and infant conditions, volume measurements were done too with the Florian Neonatal Respiration Monitor (Acutronic, Hirzel, Switzerland) that has been validated for measurements of very small VTs (Scalfaro, Pillow et al. 2001), and results from the flow curve were compared with numbers displayed by the Florian. If the numbers were different, than calibration and recording were done again.