

SEVEN VENTILATORS DELIVERING NASAL CPAP CHALLENGED WITH LEAKAGE: AN EXPERIMENTAL PILOT STUDY

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The seven ventilators showed large variations in pressure stability and ability to maintain pressure when exposed to leakage.

Ability to maintain mean pressure and provide pressure stable NCPAP are different aspects of NCPAP systems.

Compensation for leakage does not necessarily give more pressure stable NCPAP.

Background

This is the third simulation study investigating properties of NCPAP systems from our group. The pilot study examines changes in mean pressure and pressure stability for seven ventilators in NCPAP mode when challenged with leakage

Methods

Neonatal breathing was simulated by using a mechanical lung simulator. Seven ventilators were tested with recommended prongs, humidifier and tubing. Tests were performed with a breath profile from a 3,4 kg infant and nCPAP of 4 cm H₂O. Constant leakage at 1-2-3-4 l/min was introduced after 30 breaths. Pressure stability was measured as pressure increase and decrease from mean pressure. Leakage stability was measured as change in mean pressure. Calculations were performed for each breath.

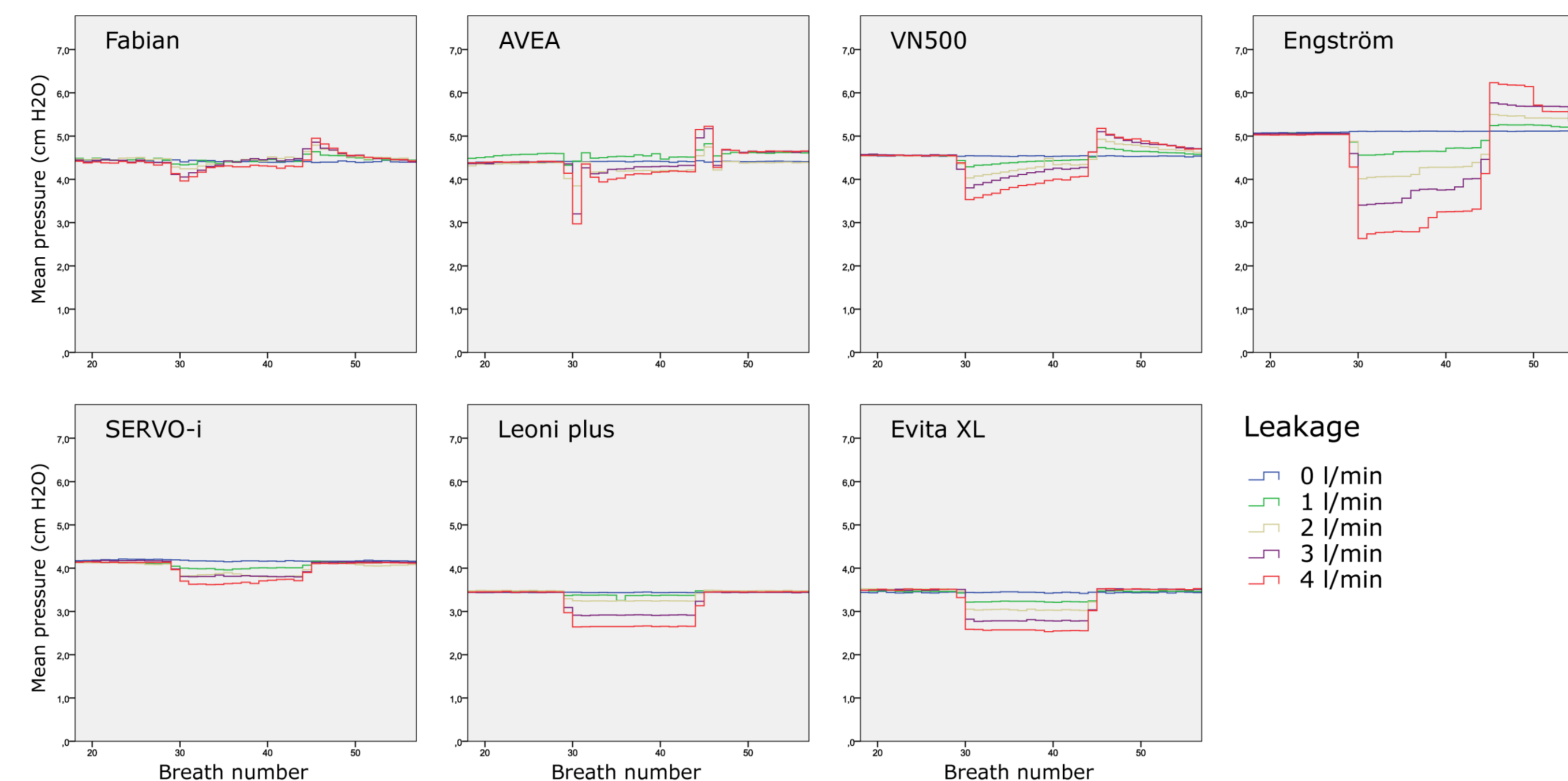


Figure 1: Ability to maintain mean pressure: Mean pressure change during leakage (1-4 l/min) between breath number 30 and 45. Top row ventilators compensate for leakage.

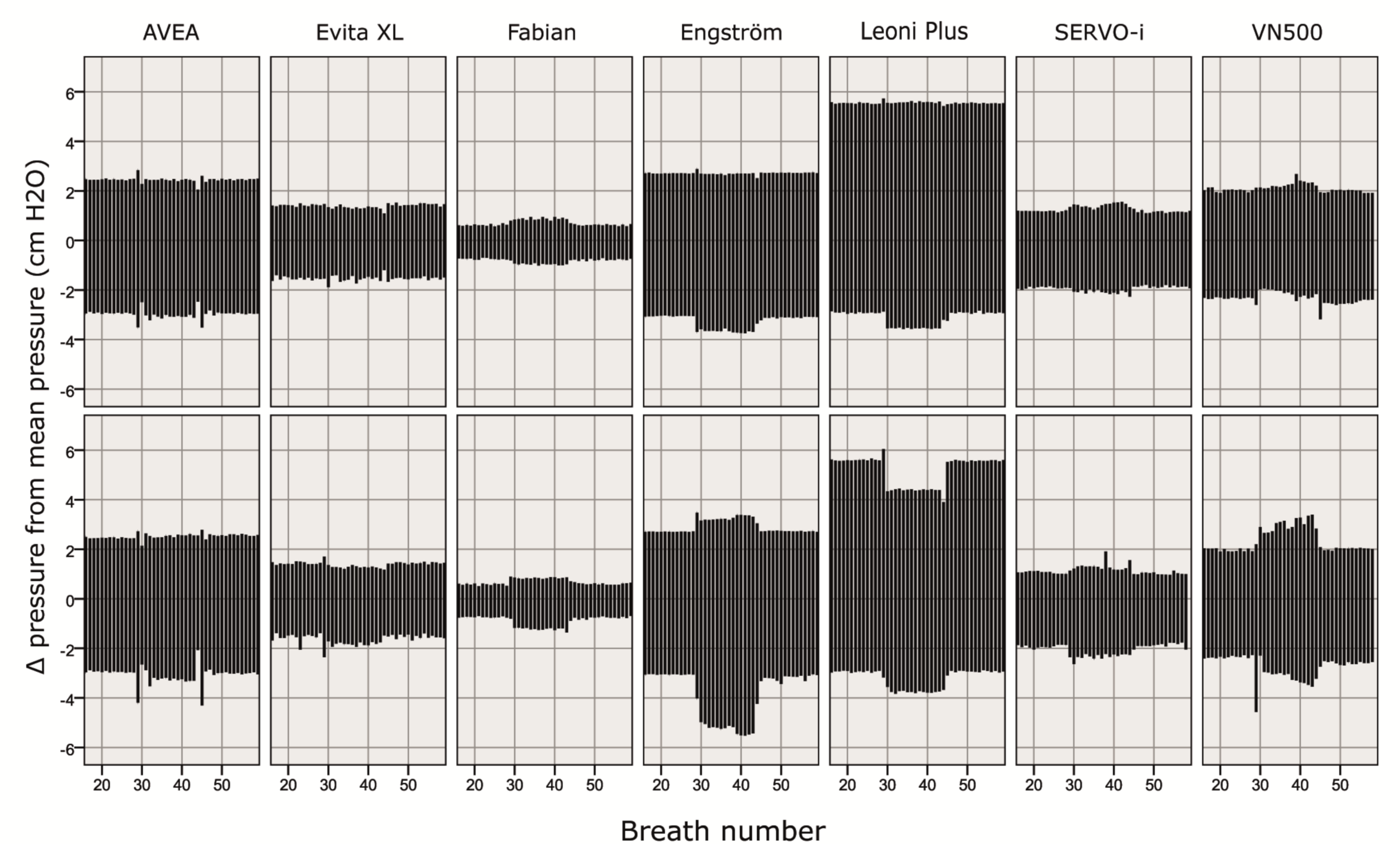


Figure 2: Ability to provide pressure stable NCPAP: Illustration of pressure swings around mean pressure. Leakage (2 and 4 l/min) between breath number 30 and 45.

Results

Changes in mean pressure with leakage showed large variations and four of the ventilators had leak compensation (Fig. 1).

The pressure stability of the tested ventilators showed large variations before introducing leakage (Fig. 2).

Fabian, Evita XL and SERVO-i were the most pressure stable systems (with and without leakage).

Implications

The clinical importance of pressure stability and ability to maintain mean pressure is not known.

This might be of importance in clinical studies of NCPAP systems.

Future in vitro studies of NCPAP delivered by ventilators need to include both aspects of pressure stability since the response is not predictable.



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Disclosure: Kjell Nilsson is one of the inventors of Infant Flow and has received royalties until 2011. Baldvin Jonsson has been engaged as a medical consultant for Maquet Critical Care.



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