

RESEARCH SUMMARY

Neonatal nasal CPAP and leaks: Evaluating the responses of seven ventilators

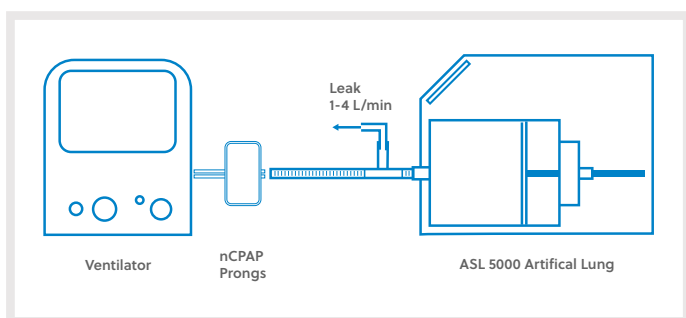
A summary of an article by Drevhammar et al.¹

Study methods

Seven different CPAP systems (see table) with recommended nasal prongs and humidifiers were connected to an ASL 5000 (IngMar Medical, USA) artificial lung for testing. The ventilators were set to provide a CPAP level of 4 cm H₂O and four levels (1,2,3 and 4 L/min) of leaks were introduced. After applying the leak, the change in CPAP and the amplitude of the pressure swings (calculated as the difference between lowest and highest pressure for each breath) were then evaluated over 15 consecutive breaths.

Results

In most of the systems tested, the CPAP level decreased when increasing the leak level. fabian (ZOLL Medical, USA), Avea (Vyair, USA) and Servo-i (Maquet, Sweden) produced the least reduction in delivered CPAP. fabian, Evita XL (Dräger, Germany), and Servo-i ventilators showed the smallest pressure swing. Four of the seven tested ventilators have a built-in leak compensation algorithm, which gradually compensates for the initial drop in delivered CPAP. When investigators paused the leak, these four ventilators showed an overshoot of the delivered CPAP. fabian and Avea ventilators compensated in less than 5 breaths, whereas Babylog VN 500 (Dräger, Germany) and Engström Carestation (GE Healthcare, UK) did not return to the pre-leak delivered CPAP after 15 breaths.



Experimental setup: The ventilator was connected to the lung simulator with the dedicated nasal CPAP system.

¹Drevhammar T, et al. Seven Ventilators Challenged With Leaks During Neonatal Nasal CPAP: An Experimental Pilot Study. *Respiratory Care*. July 2015;60(7):1000–1006. doi: <https://doi.org/10.4187/respcare.03718>

*ZOLL fabian ventilators are not approved for use in the United States.

Objectives

Nasal CPAP (nCPAP) is widely used in the neonatal intensive care unit. Several variables influence its effectiveness, including leaks at the patient interface and the delivery of pressure stable CPAP. Pressure stability when a leak is present has not been investigated in detail. Therefore, the goal of this bench study was to evaluate the performance of seven ventilators delivering nasal CPAP when challenged with leaks at the patient interface.

Ventilator	Decrease in CPAP (cm H ₂ O)	Pressure swing (cm H ₂ O)	Compensation speed
fabian	<0.5	1.4	<5 breaths
Avea	1.5	4.5	<5 breaths
Babylog VN500	1	4	<15 breaths
Engström Carestation	2	5	None [†]
Evita XL	1	2	None
Leoni Plus	1	8.5	None
Servo-i	0.5	2.5	None

[†]Ventilator did not compensate

Key Takeaways

- Compared to the Avea, VN500, Engström Carestation, Evita XL, Leoni Plus, and Servo-i ventilators, the ZOLL fabian ventilator with Infant Flow[®] LP showed the lowest decrease in CPAP level and the smallest pressure swing at different leak levels (1–4 L/min).
- The fabian and Avea ventilators compensated for the leak within 5 breaths, whereas the Babylog VN500 and Engstrom Carestation ventilators did not return to the pre-leak delivered CPAP after 15 breaths.
- The clinical importance of these findings should be clarified in a clinical study.

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