microbiome in BAL or EBC samples. However, BAL and EBC with larger bacterial biomasses may have detectable signals of SCFA that correlate with bacterial DNA signatures.

We acknowledge that there are limitations of this small pilot study. First, our tests were done at a single site, on a single instrument, and we did not rigorously test reproducibility. Although the possibility of vial, column, or instrument contamination cannot be completely ruled out, nondetection of SCFA in neat MTBE suggests that these potential sources of contamination did not contribute to our findings. Furthermore, an LC-MS assay confirmed that there are detectable SCFAs in water. We also acknowledge that the limits of detection for SCFA may vary for different assays and that in samples with higher bacterial biomass, correlations between SCFAs and specific microbial taxa may exist.

In conclusion, concentrations of SCFA in BAL and EBC from healthy control subjects are similar to those in water. These results highlight the need to include negative control samples when conducting SCFA assays of respiratory samples and likely other nonfecal samples. Furthermore, because we found detectable SCFA concentrations in samples containing only purified water from numerous different sources, SCFA data generated from such samples need to be interpreted with caution because they may not represent a true biological signal. ■

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A New Configuration for Helmet Continuous Positive Airway Pressure Allowing Tidal Volume Monitoring

To the Editor:

Continuous positive airway pressure (CPAP) is a form of respiratory support that can improve oxygenation (1), limiting the risk of patient–ventilator asynchrony and delivery of high V_T in spontaneous breathing patients with acute hypoxemic respiratory failure. CPAP via helmet compared with face mask could reduce aerosolization of secretion to the environment and operators, increasing safety during viral respiratory infection outbreaks (2).

Author Contributions: A.C. conceived the content of the study, collected the data, performed the analysis, wrote the manuscript, and approved its final version. G.A. contributed to the conception of the study, collected the data, helped in performing the analysis, wrote the manuscript, and approved its final version. L.B. helped in the acquisition, analysis, and interpretation of the data; revised the manuscript for important intellectual content; and approved its final version. M.I., G.I., and F.V. helped in the acquisition of the data, revised the manuscript for important intellectual content, and approved its final version. A.G. contributed to the conception of the study, collected the data, revised the manuscript for important intellectual content, and approved its final version. C.G. conceived the content of the study, collected the data, performed the analysis, wrote the manuscript, and approved its final version.

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Figure 1. Picture of the proposed helmet continuous positive airway pressure configuration. (A) A mannequin head is wearing a continuous positive airway pressure helmet. The helmet inspiratory port (B) is connected to the turbine-driven ventilator (C) in intentional leak configuration via a single-limb circuit (D) with antimicrobial filter (E). The expiratory port (F) is equipped with an antimicrobial filter (G) capped with a connector having a hole of internal diameter 5.5 mm to allow the intentional leak as indicated by the arrow.

Although mandatory when treating acute hypoxemic respiratory failure (3), V_T measurement via a helmet was previously not feasible because of its specific mechanical properties. We report the results of a bench and human study on a simple configuration for delivering helmet CPAP by using a turbine-driven ventilator and accurately estimating V_T while limiting the unintentional leak.

We performed a bench and human study to test the hypothesis that a ventilator can accurately estimate V_T when a helmet is used in CPAP mode in a single-limb configuration with an intentional leak port placed at the helmet expiratory port. We have recently demonstrated the effectiveness of this setup in bilevel mode (4).

The bench study was performed by using a lung simulator (LS—ASL 5,000; Ingmar Medical) in a restrictive condition (resistance 7.5 $mH_2O/L/s$, compliance 30 ml/cm H_2O; inspiratory muscle pressure -12 cm H_2O) and a modified mannequin head (Laerdal Medical AS). The helmet (CaStar, R Next; Intersurgical) inspiratory port was connected to the turbine-driven ventilator (Trilogy Evo Philips; Respironics) with dedicated software (version 1.03.01.00) via a single-limb circuit while the expiratory port was capped with a connector having a hole with a 5.5-mm internal diameter to allow the intentional leak (as indicated by the arrow in Figure 1). The ventilator was provided with a blender and a high oxygen pressure inlet. The setup was tested at CPAP of 8, 10, and 12 cm H_2O. We avoided the unintentional leaks defined as any leak from the helmet collar in addition to the intentional leak from the expiratory port. The helmet was fixed to the mannequin head and sealed with tape. The ventilator monitoring system measured and displayed the overall leaks (intentional plus unintentional). Data were collected by the ventilator and lung simulator. Differences in V_T between the ventilator and lung simulator were compared during the last 15 breaths of each trial to ensure the stability of the system (4).

After obtaining written informed consent, four healthy volunteers, one female and three males with a mean age of 32 ± 4 years and mean body weight of 68 ± 10 kg, were ventilated in CPAP 8 cm H_2O via a helmet (Castar, Next Intesurgical, size small or medium; Intesurgical), using the same ventilator configuration used in the bench study. A mouthpiece was inserted in the volunteer's mouth and connected to a pneumotachograph (VT mobile; Fluke) to measure the subject's airflow and V_T. A nose clip was used to avoid respiration through the nose apart from the pneumotachograph. Unintentional leaks were avoided by selecting the appropriate helmet size according to the measured size of the volunteer's neck. Data were collected by the ventilator and by the pneumotachograph. V_T and respiratory rate were collected over 2 minutes. Differences in V_T between the ventilator's measurement and pneumotachograph results were recorded during the last 10 breaths of each trial.

In both the bench and human studies, the ventilator was set in Auto-Trak mode to avoid autotriggering, and all V_T measurements were collected at BTPS conditions. We used two antimicrobial filters placed on the helmet ports (Figure 1).

Data are expressed as mean $\pm$ SD or as median and interquartile range (IQR), as appropriate. Bland-Altman graphs were used to plot the differences between the V_T from the ventilator and lung simulator against the average of the two measurements. We used Prism 7 (GraphPad Software) and Microsoft Excel (version 2013; Microsoft Corporation).

Figure 2 shows the Bland-Altman plot showing the agreement between the V_T measured by the ventilator and lung simulator. The overall bias was -2.5 ml (95% level of agreement, -8.6 ml to 3.7). The effect of the CPAP level on the agreement seemed to be negligible because the percentage differences in V_T measured by

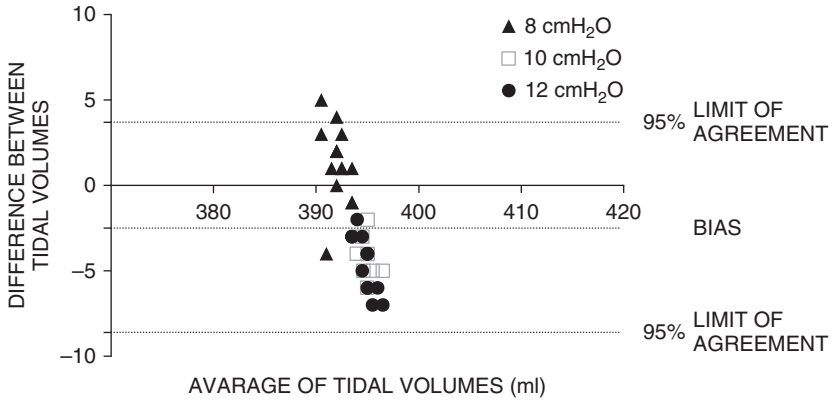

Figure 2. Bland-Altman plot of the differences (*y*-axis) versus average of V_Ts (in milliliters, *x*-axis) measured by the turbine-driven ventilator and the lung simulator in the restrictive pattern conditions. Volume data are reported in milliliters. The different conditions of continuous positive airway pressure are reported in centimeters H_2O. *x*-Axis: average of the two measurements; *y*-axis: difference between measurements. Bias: average of the differences between measurements. Ninety-five percent limits of agreement: ± 1.96 SD of the bias.

ventilator and the lung simulator were 1.3% (±0.5), 1% (±0.3), and 0% (±0.4) at 8, 10, and 12 cm H_2O, respectively.

The amount of overall leaks (intentional plus unintentional) in the bench study was 38.7 L/min (IQR, 38.5–38.9) at 8, and 43.6 L/min (IQR, 43.5–43.9) at 10, and 48.6 L/min (IQR, 48.5–48.8) at 12 cm H_2O. Percentage differences in V_T measured by the ventilator and the pneumotachograph for the four healthy volunteers was −2.5% (±12), −5% (±3.5), 1% (±11), and −6 (±6), respectively. In the healthy volunteers, median values of overall leaks (intentional plus unintentional) were 37.7 L/min (IQR, 37.1–38.3).

For the first time, we demonstrated the ability of a ventilator to estimate inspired V_T during helmet CPAP mode. ICU ventilators in pressure support modes (with or without positive end-expiratory pressure) failed to monitor V_T accurately because of the distension of the helmet and poor estimation of the unintentional leak. The accurate measurement of V_T is clinically important to employ protective lung ventilation. Reliable monitoring of V_T during helmet CPAP can help the clinician to recognize a worsening of the patient's respiratory drive or respiratory compliance in an early phase (3, 5). Of note, helmet CPAP can be delivered for longer periods with a lower risk of skin breakdown and with higher comfort compared with face masks. The proposed configuration also discourages additional carbon dioxide rebreathing in comparison with helmet CPAP using two-limb ICU ventilators (6).

We did not measure aerosolization. Unintentional leaks can contaminate the environment because they contain exhaled air from the patient and do not pass through the filter. They were absent during the bench study because of the designed setup, and they were negligible in the human study. Thus, the overall leaks measured by the ventilator's display were reflecting only the intentional leaks. Further testing, especially related to aerosolization, is needed in a clinical setting. This configuration may be eventually useful to deliver CPAP in patients with viral infections, such as coronavirus disease (7). We used a specific ventilator in our study and anticipate that results may vary with ventilators from different sources, but this algorithm may be shared with other ventilator makers. We used intentional leaks from a connector having a hole with a 5.5-mm internal diameter. Although already published (4), this port has not been previously validated clinically.

One of the authors (C.G.) was part of an international board that participated in the manufacturing process of the Evo ventilator. Although we received help from a manufacturer expert in the development of the ventilator algorithm, the authors were responsible for conception, data collection, and interpretation and the writing of this manuscript. ■

Author disclosures are available with the text of this letter at www.atsjournals.org.

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A Novel Role for Bronchial MicroRNAs and Long Noncoding RNAs in Asthma Remission

To the Editor:

Complete asthma remission in adulthood occurs in a minority of patients, but knowledge about its fundamental mechanisms is

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Author Contributions: G.H.K. and M.v.d.B. designed the study. I.M.B. and M.M.T. performed statistical analyses under the supervision of C.J.V., K.K., V.G., and M.v.d.B. M.P.R., and M.C.N. contributed to data acquisition. I.M.B. drafted the manuscript under the supervision of G.H.K., V.G., and M.v.d.B. All authors contributed to interpretation of the data and critically reviewed and approved the manuscript.

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