Bicarbonate or Base Excess in Early Obesity Hypoventilation Syndrome
A Methodologic Viewpoint

To the Editor:
In a recent issue of CHEST (February 2015), Manuel et al1 reported an original study on obese subjects suggesting that a raised bicarbonate concentration ([HCO$_3^-$]), without awake hypercapnia, could allow the early detection of obesity hypoventilation syndrome (OHS). Since bicarbonate was announced as a potential discriminant biomarker, methodologic issues about its determination should be considered.

Throughout the article, the authors focused on base excess (BE), which was used for the characterization of the three groups (ie, normal daytime PaCO$_2$ ≤ 6 kPa associated with BE < 2 mmol/L [non-OHS] or BE ≥ 2 mmol/L [early OHS], and elevated daytime PaCO$_2$ > 6 kPa [OHS]). Overall, the authors highlighted BE in early OHS rather than arterial standard [HCO$_3^-$]. Nevertheless, results show a strong overlap of arterial standard [HCO$_3^-$] and BE values between early-OHS and OHS groups. It should be noted that arterial standard [HCO$_3^-$] obtained from the ABL90FLEX blood-gas analyzer (Radiometer Medical ApS) is not measured but calculated according to complex formulas including correction factors for hemoglobin and oxygen saturation and that BE is calculated from arterial standard [HCO$_3^-$]. Previous analytical comparisons of blood-gas analyzers have shown that BE values strongly differ between devices, especially due to the difference between calculation formulas, and that the reproducibility of BE measurements was not as good as those for arterial standard [HCO$_3^-$].2 Moreover, as referenced on the Westgard QC website,3 within- and between-subject biologic BE variability is much larger than that of bicarbonate (76.4% and 43.2% compared with 4.0% and 4.8%, respectively), making the use of BE in early OHS somewhat questionable.

As recently emphasized, the characterization of OHS would need to be redefined, since PaCO$_2$ is too fluctuant and influenced by many factors, and BE > 3 mmol/L or arterial standard [HCO$_3^-$] > 27 mmol/L (without another cause for metabolic alkalosis) were proposed as cutoffs.4 A question arises: Which is the more relevant alkaline indicator between calculated BE and arterial standard [HCO$_3^-$]? Following the debatable recommendations mentioned, and given the lower reliability of BE, the use of arterial standard [HCO$_3^-$] as a cutoff between groups would probably have been more relevant as follows: normal daytime PaCO$_2$ ≤ 6 kPa associated with arterial standard [HCO$_3^-$] ≤ 27 mmol/L (non-OHS) or arterial standard [HCO$_3^-$] > 27 mmol/L (early OHS), and elevated daytime PaCO$_2$ > 6 kPa associated with arterial standard [HCO$_3^-$] > 27 mmol/L (OHS).

Finally, since blood-gas analyses are sensitive to many preanalytical variations,5 measured venous bicarbonate concentration would probably be an interesting alternative for early-OHS screening, especially since venipuncture is easier to achieve and causes the patient less apprehension. The next challenge will aim to determine the most specific alkaline indicator for detection of early OHS while considering these methodologic issues.

Denis Monneret, PharmD, PhD
Paris, France

AFFILIATIONS: From the Department of Metabolic Biochemistry, La Pitié Salpêtrière-Charles Foix University Hospital (AP-HP).

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CORRESPONDENCE TO: Denis Monneret, PharmD, PhD, Department of Metabolic Biochemistry, La Pitié Salpêtrière-Charles Foix University Hospital (AP-HP), 47-83 Boulevard de l’Hôpital, 75013 Paris, France; e-mail: dmonneret2@gmail.com

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