

## CORRESPONDENCE

# Exhaled nitric oxide concentration is influenced by alcohol containing disinfectants

To the Editor:

Nitric oxide (NO) is produced by many inflammatory cells [1]. Asthma is a disease in which inflammation plays an important role. Nitric oxide can easily be measured in the exhaled air of asthmatics and is used in research settings as a marker for inflammation [2]. Several studies, starting with ALVING *et al.* [3] in 1993, have shown increased amounts of NO in the exhaled air of asthmatic patients and normal values after treatment with corticosteroids. NO in exhaled air is measured by chemiluminescence.

We measure NO by having the patient inhale air with very low NO concentrations (1–3 parts per billion (ppb)). Values of NO measured in exhaled air by this method range approximately 5–40 ppb [4]. By chance we found a problem with the NO measurement after cleaning the breathing system with an alcohol containing disinfectant. We observed a sharp rise in NO readings and even more in NO<sub>2</sub> values. We tested the influence of ethanol by administering a gas mixture containing about 5 vol% of ethanol vapour to the analyser. This resulted in a reading of 22 ppb NO, while ambient concentrations were only 2 ppb NO. A similar result was observed with a second brand of chemiluminescence analyser. Additionally, we mimicked a small spill of disinfectant by spraying 0.5 mL of cleaning substance (chlorhexidine 0.5% in 70% ethanol) into the tube leading to the collecting bag for exhaled air, while performing a normal procedure for measuring NO in four subjects. Between every measurement, the system was totally dried with air for 10 min. A mean (range) baseline NO concentration of 19.7 (12–24) ppb was recorded, which increased to 24.3 (18–28) ppb after adding the disinfectant. One subject even showed an increase of 51% in NO reading.

The explanation is probably that ethanol disintegrates in the reacting chamber into water and ethane, which is a known source of interference in chemiluminescence measurement [5]. Other organic fluids frequently used in a hospital environment (acetone, ether, methanol) did not influence the NO measurement, even when administered in high concentrations.

Since NO<sub>2</sub> measurements showed a much larger percentage increase when adding ethanol-containing substances to the system, simultaneous measurements of NO and NO<sub>2</sub> can therefore be used to monitor contaminating substances, such as ethanol.

Because the rise in NO readings with alcohol is only slightly smaller than the rise during mild asthma exacerbations, we consider this influence of important clinical interest. To our knowledge, alternative non-alcohol-containing disinfectant fluids with sufficient bactericidal activity are not available. Therefore, we advise that only the mouthpiece should be changed between subsequent measurements and, furthermore, that the complete breathing system should be cleaned with alcohol-containing substances only at the end of the day, so that ethanol can evaporate completely before the next day's measurements.

## References

1. Moncada S, Higgs A. The L-arginine-nitric oxide pathway (Review). *N Engl J Med* 1993; 329: 2002–2012.
2. Borland C. Measurement of exhaled nitric oxide in man. *Thorax* 1993; 48: 1160–1162.
3. Alving K, Weitzberg E, Lundberg JE. Increased amounts of nitric oxide in exhaled air of asthmatics. *Eur Respir J* 1993; 6: 1368–1370.
4. Seitz WR, Neary MP. Chemiluminescence and Bioluminescence Analysis in Analytical and Clinical Chemistry. In: Hercules DM, ed. New York, London, Plenum press, 1977; 2: 49–61.
5. Schilling J, Holzer P, Guggenbach M, Gyurech D, Marathia K, Geroulanos S. Reduced endogenous nitric oxide in the exhaled air of smokers and hypertensives. *Eur Respir J* 1994; 7: 467–471.

**R.J. Meijer, H.A.M. Kerstjens, D.S. Postma, G.H. Koëter, Th.W. van der Mark**  
Dept of Pulmonary Diseases, University Hospital Groningen, Groningen, The Netherlands.