# Letters to the Editor

## Central nervous system oxygen toxicity during 100% oxygen breathing at normobaric pressure

I read with interest the report of symptoms suggesting central nervous system (CNS) oxygen toxicity while breathing carbon dioxide ($CO_2$)/oxygen ($O_2$) mixtures at ambient pressure,[1] which Dr Eynan and colleagues concluded may have been due to normobaric CNS $O_2$ toxicity. While perhaps plausible, it should be noted that similar symptoms also consistent with $O_2$ toxicity have been reported from hypercapnia alone. These have included muscle twitching, facial tremors, myoclonus, extremity paralysis, hyporeflexia, flaccid paralysis, impaired consciousness and generalized convulsions.[2,3] In a study of normoxic, normal volunteers (inspired $PO_2$ 21.3 kPa [0.21 atmospheres (atm)]) breathing $CO_2$ at 6.6–8.6 kPa (0.065–0.085 atm) in a dry hyperbaric chamber at 1.46 atm absolute, other symptoms typical of CNS oxygen toxicity were reported: tunnel vision, vision loss, dizziness and near-syncope.[4]

In their report, Eynan and colleagues point out the extreme sensitivity of a diver to $CO_2$. However, it is not clear that he is sensitive to $O_2$. Notwithstanding the rarity of this man's symptoms, rather than an uncommon manifestation of CNS $O_2$ toxicity, the diver's symptoms at sea level pressure may instead be a rare manifestation of $CO_2$ narcosis at relatively low $PCO_2$. The authors should test their hypothesis by exposing the diver in a blinded manner to $CO_2$ at low and high $PO_2$.

### References


1 Eynan M, Arieli Y, Taran B, Yanir Y. Symptoms of central nervous system oxygen toxicity during 100% oxygen breathing at normobaric pressure with increasing inspired levels of carbon dioxide: A case report. Diving Hyperb Med. 2020;50:70–4. doi: 10.28920/dhm50.1.70-74. PMID: 32187621.

2 Sieker HO, Hickam JB. Carbon dioxide intoxication: the clinical syndrome, its etiology and management with particular reference to the use of mechanical respirators. Medicine (Baltimore). 1956;35:389–423. PMID: 13407339.

3 O'Reilly RJ. The clinical recognition of carbon dioxide intoxication. Dis Chest. 1960;37:185–92. doi: 10.1378/chest.37.2.185. PMID: 14428118.

4 Gill M, Natoli MJ, Vacchiano C, MacLeod DB, Ikeda K, Qin M, et al. Effects of elevated oxygen and carbon dioxide partial pressures on respiratory function and cognitive performance. J Appl Physiol (1985). 2014;117:406–12. doi: 10.1152/japplphysiol.00995.2013. PMID: 24947022.


**Submitted:** 16 June 2020
**Accepted:** 17 June 2020

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**Key words**
Carbon dioxide; Hypercapnia; Hyperoxia; Toxicity; Side effects; Letters (to the Editor)

doi: 10.28920/dhm50.3.306. PMID: 32957137.



## Reply

I should like to thank Dr Richard Moon for his comments on our article.[1] I read with interest his letter regarding the possibility that the symptoms we reported may have been due to hypercapnia alone, because our subject was breathing 100% oxygen at normobaric pressure. He reached this conclusion on the basis of the article by Gill and colleagues,[2] in which symptoms akin to those associated with central nervous system (CNS) oxygen toxicity were detected when the inspired $PCO_2$ was between 6.6–8.6 kPa (0.065–0.085 atm).

I should like to raise two points, which may demonstrate that the diver in question is in fact highly sensitive to oxygen.

1. During his interview before the test, the subject complained of dizziness, headaches and nausea he had experienced during the series of dives using closed-circuit apparatus commenced two weeks previously. It is unlikely that he would have suffered from severe hypercapnia during his dives with the oxygen rebreather. It is more plausible that with no elevation at all of $CO_2$ in his inspired gas thanks to the $CO_2$ absorbent, the only aspect we have to consider in our attempt to determine the reason for his symptoms may be the hyperbaric oxygen he inspired during the dive.

2. When the $CO_2$ in the subject's inspired gas reached a level of 2 kPa during the $CO_2$ detection test, he complained of severe dizziness and headache. With $CO_2$ in excess of 3 kPa, he also reported twitching of his facial muscles, especially around the mouth. However, this level of inspired $CO_2$ is much lower than that reported by Gill and colleagues.[2]

These two points would indicate that our diver may have been extremely sensitive not only to $CO_2$, but also to hyperbaric oxygen.