

# A Rare Cause of Chronic Headache that May Be Misdiagnosed as Migraine: Chronic Carbon Monoxide Poisoning

Migren ile Karışabilen Nadir bir Kronik Baş Ağrısı Nedeni: Kronik Karbon Monoksit Zehirlenmesi

Mehmet Kenan KANBUROGLU, Mehmet Nevzat CIZMECI, Ahmet Zulfikar AKELMA

Department of Pediatrics, Turgut Ozal University Faculty of Medicine, Ankara

## SUMMARY

Differential diagnosis of primary headache disorders can be challenging for physicians. Although the association of headache with acute carbon monoxide intoxication is very well-defined, in refractory nonspecific headaches associated with chronic low dose exposure to carbon monoxide, CO intoxication is usually overlooked, mostly due to vague symptoms. Herein we present a 15-year-old female patient with chronic carbon monoxide poisoning who was undergoing two years of follow-up care for migraines. Chronic carbon monoxide intoxication may mimic the episodic nature and familial predisposition of migraine attacks. Normal carboxyhemoglobin levels do not exclude the diagnosis, and smoking is a confounding factor. In emergency rooms, patients presenting with headaches had higher levels of carboxyhemoglobin, but, as far as we know, there have been no studies investigating carboxyhemoglobin levels in migraine patients. Chronic carbon monoxide poisoning should be suspected in migraine patients, especially if the attacks occur during winter months.

**Key words:** Carbon monoxide; emergency; headache; migraine; pediatric.

## ÖZET

Primer baş ağrısında ayırıcı tanının yapılması bazen doktorlar açısından zor olabilmektedir. Literatürde karbon monoksit ile baş ağrısı arasındaki ilişki çok iyi ortaya konulmuş olmasına karşın, dirençli ve nonspesifik baş ağrısı nedenlerinden biri olan kronik düşük doz karbon monoksit maruziyeti kendine özgü bulgusu olmadığından sıklıkla atlanmaktadır. Bu yazıda, iki yıl migren tanısı ile takip ve tedavi edilen kronik karbon monoksit zehirlenmesi olan bir olgu sunuldu. Kronik karbon monoksit zehirlenmesi epizodik paterni ve aile fertlerinde benzer şikayetlerin olması nedeniyle migren ataklarını andırabilmektedir. Karboksihemoglobin konsantrasyonlarının normal saptanması tanıyı ekarte ettirmekte, ayrıca sigara kullanımı da karıştırıcı bir faktör olabilmektedir. Acil servislerine baş ağrısı ile başvuran hastaların karboksihemoglobin seviyeleri baş ağrısı olmadan acile başvuran hastalardan daha yüksek saptanmaktadır; fakat bildiğimiz kadarı ile karboksihemoglobin seviyesi ile migren arasındaki ilişkinin araştırıldığı bir çalışma literatürde bulunmamaktadır. Migren atakları özellikle kış aylarında tekrarlayan hastalarda kronik karbon monoksit zehirlenmesi akılda tutulmalıdır.

**Anahtar sözcükler:** Karbon monoksit; acil; baş ağrısı; migren; çocuk.

## Introduction

Acute carbon monoxide (CO) poisoning is the cause of most CO-related admissions to the emergency department and is the source of most scientific knowledge about CO intoxication.<sup>[1]</sup> Chronic low-dose CO intoxication is usually overlooked, mainly due to moderately low carboxyhemoglobin

(COHb) levels and to the lack of the specific symptoms of acute intoxication. A wide range of symptoms, including dizziness, paresthesia, chest pain, palpitations, abdominal pain, diarrhea and visual disturbances may be associated with chronic CO poisoning; however, most patients only have flu-like symptoms and headache.<sup>[2]</sup> Herein, we present

**Submitted:** March 05, 2013 **Accepted:** April 01, 2014 **Published online:** June 24, 2014

**Correspondence:** Dr. Mehmet Kenan Kanburoglu, Turgut Ozal Üniversitesi Tıp Fakültesi, Pediatri Anabilim Dalı, Emek, 06510 Ankara, Turkey.

**e-mail:** madduckk@gmail.com

Open access under [CC BY-NC-ND license](#).



a patient with chronic carbon monoxide poisoning who was undergoing follow-up care for two years for the diagnosis of migraines.

## Case Report

A 15-year-old girl was admitted to the pediatric emergency room after suffering from a headache that did not respond to analgesics. The headache was described as a diffuse pain, which was worse in the evenings but gradually disappeared at school. She was admitted to the hospital three times in the previous week and her condition improved after injection of an analgesic on all occasions. Her headaches were not waking her from sleep and were not related to meals.

Her medical history revealed that she had been in the follow-up care of a pediatric neurologist for migraine over the last two years, and she had nine migraine attacks since then. These headaches met the diagnostic criteria for migraine without aura.<sup>[3]</sup> Her mother and father also had headaches, and her mother had been diagnosed with migraines as well. Both her migraine attacks and those of her mother usually appeared on similar occasions and mostly in winter. She was the only child in her family, and there was no history of smoking or second-hand smoke exposure.

On examination, her vital signs showed a blood pressure of 106/61 mmHg, a heart rate of 106 beats/min, a respiratory rate of 30 breaths/min and a temperature of 36.8 °C. The patient had normal neurologic, respiratory, cardiovascular, musculoskeletal and abdominal examinations, although she had a borderline tachycardia and tachypnea, which were attributed to the headache.

Carbon monoxide poisoning was suspected because the headaches only occurred at home and usually at the same time as other family members. A venous blood gas sample was taken an hour after she left the house, and it revealed a COHb level of 11.9%. Two hours after oxygen treatment, her symptoms were relieved. Blood samples were also taken from the mother and father, which revealed COHb levels of 11.1% and 7.9%, respectively.

Investigation at home revealed a leaking domestic gas burner in the kitchen. Direct measurement showed 78 parts per million (ppm) of carbon monoxide throughout the kitchen. The patient was followed for one year after identification and repair of the cause, during which time only one episode of headache occurred. An MRI scan of the patient taken three months after the diagnosis was unremarkable. The final diagnosis of the patient was confirmed to be chronic CO poisoning due to prolonged exposure to non-lethal concentrations of CO.

## Discussion

CO is a colorless, odorless and nonirritant gas, so patients do not realize they are being exposed to poison. The classic symptoms of acute CO intoxication, such as syncope, palpitations, chest pain, and seizures, are unexpected in patients with chronic CO poisoning and migraine. Patients with chronic CO poisoning may be diagnosed with chronic fatigue syndrome, depression, and influenza in the emergency room.<sup>[4]</sup>

Although migraine may have a familial predisposition, similar symptoms may also occur in the family members of a patient with CO exposure. Moreover, occasional increases in carbon monoxide exposure may mimic the episodic nature of migraine attacks. Normal COHb levels do not exclude the diagnosis of CO poisoning because COHb levels may decrease before the patient's admission to the hospital, as its elimination half-life in room air is about five hours.<sup>[5]</sup> Furthermore, smoking is a confounding factor in the differential diagnosis of chronic CO poisoning; smokers' COHb levels may range from 1-14%.<sup>[6]</sup> A biochemical marker for chronic CO poisoning has yet to be found. Occasionally, household pets that were found dead or behaving strangely may provide an important clue to the diagnosis.<sup>[2]</sup>

In the present case, low levels of serum COHb and indoor CO, and the absence of the classical findings of acute CO intoxication led us to the diagnosis of chronic carbon monoxide poisoning. However, some of her previous migraine attacks may have been acute CO intoxication.

The association between unsuspected CO poisoning and headache has been investigated in several studies. Heckerling et al.<sup>[4]</sup> investigated the frequency of occult CO poisoning in patients presenting with headache and dizziness. Of 48 patients presenting with headache, they found increased levels of COHb (greater than 10%) in seven patients, giving a prevalence of 14.6% for CO intoxication. Clarke et al.<sup>[7]</sup> measured COHb levels of 1758 patients using a pulse CO-oximeter and venous samples. They found that patients presenting with headaches, flu-like symptoms, chest pains, or seizures had higher levels of COHb. Ambient levels of carbon monoxide, such as long-term exposure to traffic-related air pollution, may also increase daily emergency department visits for headache.<sup>[8]</sup> To the best of our knowledge, there has been no study investigating migraine cases to determine if they are the result of chronic CO poisoning.

In conclusion, in patients who have the diagnosis of migraine or present with non-specific refractory headaches, chronic carbon monoxide poisoning should be suspected, especially if the attacks occur during the winter months.

### Conflict of Interest

The authors declare that there is no potential conflicts of interest.

### References

1. Wright J. Chronic and occult carbon monoxide poisoning: we don't know what we're missing. *Emerg Med J* 2002;19:386-90.
2. Kirkpatrick JN. Occult carbon monoxide poisoning. *West J Med* 1987;146:52-6.
3. Headache Classification Subcommittee of the International Headache Society. The International Classification of Headache Disorders: 2nd edition. *Cephalalgia* 2004;24 Suppl 1:9-160.
4. Heckerling PS. Occult carbon monoxide poisoning: a cause of winter headache. *Am J Emerg Med* 1987;5:201-4. [CrossRef](#)
5. Myers RA, Linberg SE, Cowley RA. Carbon monoxide poisoning: the injury and its treatment. *JACEP* 1979;8:479-84. [CrossRef](#)
6. Light A, Grass C, Pursley D, Krause J. Carboxyhemoglobin levels in smokers vs. non-smokers in a smoking environment. *Respir Care* 2007;52:1576.
7. Clarke S, Keshishian C, Murray V, Kafatos G, Ruggles R, Coultrip E, et al. Screening for carbon monoxide exposure in selected patient groups attending rural and urban emergency departments in England: a prospective observational study. *BMJ Open* 2012;2.
8. Szyszkowicz M. Ambient air pollution and daily emergency department visits for headache in Ottawa, Canada. *Headache* 2008;48:1076-81. [CrossRef](#)