# >> EMERGENCY IMAGING

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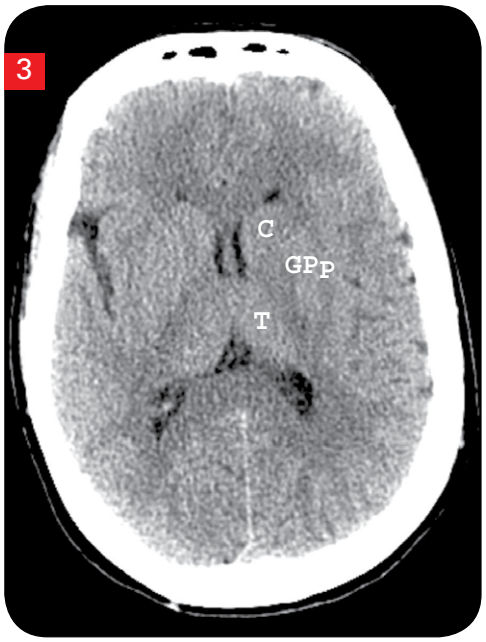
## PROBLEM


>> A 30-year-old man is brought unresponsive to the ED. Physical examination is nonrevealing, and CT is ordered. Figure 1 is a representative axial slice from that examination.

**What is your diagnosis?**

*Turn page for answer* >>

## ANSWER


>>The CT examination reveals symmetric low attenuation in the globus pallidus of the bilateral basal ganglia (white arrows, Figure 2). The basal ganglia (Figure 3) are the deep gray matter structures of the brain, ie, the caudate nucleus (C), globus pallidus (GP), putamen (P), and thalamus (T). As one of the most metabolically active regions of the brain, the basal ganglia are susceptible to diseases and processes that reduce perfusion to the cerebrum or alter its metabolism.

The differential diagnosis for an abnormality of the basal ganglia is wide; it includes degenerative diseases, such as Huntington disease; inborn errors of metabolism, such as Wilson disease; and chronic infections, such as variant Creutzfeldt-Jakob ("mad cow") disease. However, for a patient who presents acutely, a narrower differential diagnosis—including hypoxic injury due to cardiopulmonary arrest, deep cerebral vein thrombosis, or acute poisoning—should be considered. Of the acute poisonings, the most common is carbon monoxide toxicity, which is the diagnosis in this case.

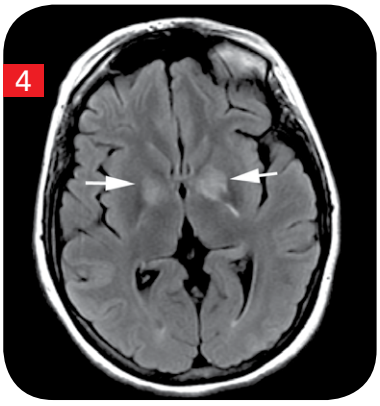
Carbon monoxide poisoning results in more than 50,000 ED visits per year.[1] It is associated with a spectrum of signs and symptoms ranging from headache to altered mental status to loss of consciousness or even death.[1] Presentation depends on degree and duration of exposure. The affinity of carbon monoxide to hemoglobin is more than 200 times that of oxygen to hemoglobin; thus, carbon monoxide exposure causes hypoxia, which can then lead to neurologic and cardiovascular insults.[1]

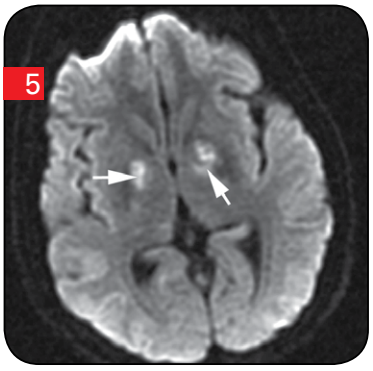
The CT image presented in this case demonstrates the typical imaging finding of bilateral focal edema in the basal ganglia, which (as in this patient) most commonly occurs within the globus pallidus. In one series, abnormality of the globus pallidus was found in 63% of patients presenting with advanced CO toxicity.[2] Edema may also be detected in the white matter of the cerebral hemisphere or in the cerebral cortex.

MRI is more sensitive than CT for the detection of cerebral edema. An axial FLAIR (fluid-attenuated inversion recovery) image obtained in this patient (Figure 4) demonstrates the presence of edema in the bilateral globi pallidi (white arrows). FLAIR imaging allows detection of edema, which is bright, by suppressing the signal from the normal intracra-

## ANSWER

nial fluid (cerebrospinal fluid). An axial diffusion-weighted image (Figure 5) confirms hypoxia and infarction within the basal ganglia, as increased signal on this sequence (white arrows) indicates restricted water motion due to dead or dying cells.




Recognizing the typical pattern of CO toxicity is important, as once this diagnosis is detected or suspected, the initial treatment should include hyperbaric oxygen. Imaging may also assist in determining prognosis, as the extent of abnormality on imaging has been shown to correlate with the clinical outcome.[2]

### References

1. Weaver LK. Clinical practice. Carbon monoxide poisoning. *N Engl J Med*. 2009;360(12):1217-1225.
2. O'Donnell P, Buxton PJ, Pitkin A, Jarvis LJ. The magnetic resonance imaging appearances of the brain in acute carbon monoxide poisoning. *Clin Radiol*. 2000;55(4):273-280.

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