

Delayed Neuropsychiatric Sequelae and Recovery Following Carbon Monoxide Poisoning

Dear Editor,

Carbon monoxide (CO) poisoning is a leading cause of death by suicide.¹ Acute CO intoxication may induce hypoxic encephalopathy with variable presentations, ranging from confusion to deep coma but most recover completely from the acute episode following CO poisoning. However, up to 30% of survivors develop neuropsychiatric and cognitive manifestations 1 week to 6 months after CO exposure and the illness trajectories are less well documented.^{2,3} Here, we report 2 cases of CO poisoning with delayed neuropsychiatric sequelae and variable course of recovery.

Case Report 1

A 44-year-old Chinese male was admitted to a general hospital following CO inhalation with Glasgow Coma Scale (GCS) value of 10. He had been feeling depressed for a few weeks and was found unconscious in a closed room with a large pot of burning charcoal about 9 hours after exposure to the smoke. Physical examination revealed soot deposition in the larynx with intact vocal cords and airway. The carboxyhaemoglobin level of the patient was found to be 27.5% and following the advice of the toxicology specialist, he was administered 100% oxygen (O₂). As the carboxyhaemoglobin level dropped to 1.8% on the following day, O₂ administration was subsequently stepped down to 4L/minute. He developed pneumonitis that was evident on the chest X-ray and a full blood count revealed neutrophilia. However he responded well to antibiotics and was then transferred to a tertiary psychiatric facility for further management of his psychiatric condition. He related feeling depressed for a month and had a prior suicidal attempt by hanging but was stopped by his family then. He was started on fluvoxamine 100 mg daily but was later changed to mirtazapine 15 mg daily. Three weeks following the CO exposure, he became less communicative, and was noted to have urinary incontinence, gait disturbance, inattention, short-term memory deficits and neglect of self-care. Electroencephalography was normal but MRI scan of the brain showed diffuse abnormal T2 hyperintensities in the subcortical white matter of both cerebral hemispheres, and extending into the external capsules, genu and body of the corpus callosum. His condition gradually improved

over the next 2 months in that his attention improved, he could recognise the family members and recall the past events. There was improvement in his gait and he regained independence in his activities of daily living. His Mini Mental State Examination (MMSE) scores improved to 25 from 15 on initial hospitalisation.

Case Report 2

A 46-year-old divorced male, with a history of major depression since 2002, presented to the general hospital for consultation following inhalation of carbon monoxide. He had made 2 suicidal attempts burning charcoal. He first attempted to burn charcoal in his house several months ago but aborted it subsequently. Six days later, he made a similar attempt in a hotel room. He reported that he regained consciousness 48 hours later with generalised weakness, giddiness, poor concentration and appetite, but managed to return to work the next day. As his symptoms did not abate after a week, he decided to seek medical attention. Physical assessment including a full neurological examination was essentially normal with GCS of 15. The serum carboxyhaemoglobin level was 3.4% and he was referred to the psychiatrist for further management. He continued on an antidepressant escitalopram and was started on a course of electroconvulsive therapy (ECT) in view of his persistent high suicidal risk. His mood improved with ECT sessions, but he subsequently became disoriented and confused after the fifth session of ECT (3 weeks post CO-poisoning). He also developed an unsteady gait and scored 11 out of 30 on MMSE. Blood investigations including toxicology, autoimmune serology, syphilis, HIV, copper, ceruloplasmin levels and cerebro-spinal fluid analysis were normal. Electroencephalography showed bi-frontal maximum generalised slowing suggestive of a mild diffuse encephalopathy with no detected epileptiform activity. Brain MRI scan showed increased diffuse, heterogeneous signals in the peri-ventricular white matter of the frontal and parietal lobes, and more extensively in the temporal and occipital lobes, with loss of differentiation of the grey-white matter. By then, he was wheelchair bound and developed fecal and urinary incontinence. He was also noted to have inattention and short-term memory difficulties. He underwent physical rehabilitation, gradually improved over 9 months and

subsequently became independent in his activities of daily living again. The repeat MMSE at 1 year was 30/30 and his brain MRI scan then showed less extensive peri-ventricular and deep white matter leukoariosis compared with the initial brain MRI scan done one year ago.

Discussion

These 2 cases highlight the different course of recovery following onset of neuropsychiatric sequelae related to CO poisoning. The first case recovered within 8 weeks following CO exposure whilst the second case was complicated by an ECT induced confusional state and subsequently made significant recovery after 9 months. Delayed neuropsychiatric manifestations are protean and include akinetic mutism, apathy, disorientation, inattention, memory deficits, slurred speech, psychosis, speech difficulties, gait ataxia, sphincter incontinence, bradykinesia and seizures.⁴ Some of these features were noted in our 2 patients presented. Brain MRI findings include lesions affecting globus pallidus and white matter changes within the centrum semiovale, corpus callosum and periventricular region.^{3,5}

Risk factors for onset of delayed neuropsychiatric sequelae include advanced age more than 36 years old, duration of exposure to CO, period of loss of consciousness, initial neurological abnormalities, positive findings on neuroimaging such as lesions in basal ganglia, white matter, and greater number of sessions of hyperbaric oxygen therapy.^{5,6} Of note, our second patient developed neuropsychiatric complications following ECT which was similar to an earlier reported case.⁷ While the exact biological cause of neuropsychiatric sequelae is unknown, cellular theories include CO related immunopathological damage leading to reversible demyelination, brain lipid peroxidation from ischaemia, oxidative and inflammatory processes.³

To date, there is no single effective treatment for these delayed neuropsychiatric sequelae and modalities tried range from hyperbaric oxygen therapy⁸ to pharmacological agents such as L-dopa, bromocriptine, steroids, ziprasidone.^{9,10} Although older age, severe neurological complications and shorter lucid intervals are associated with a poorer prognosis,¹¹ significant recovery from delayed neuropsychiatric manifestations of CO poisoning can occur as illustrated by these 2 cases. Care should also be exercised when considering ECT for treatment of psychiatric conditions associated with CO poisoning.

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