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Carbon monoxide poisoning

By Dr Steven White and Richard Morris

Introduction

There are approximately 400 admissions to hospital with Carbon Monoxide (CO) poisoning in England each year and around 40-50 deaths. CO exposure can lead to **anoxic brain injury** and this factsheet explains what CO poisoning is, its symptoms, treatment and how to prevent it. A list of further useful resources is provided at the end.

All the technical terms that are used are highlighted in bold and explained in the list of common brain injury terms on the Headway website, which is linked to at the end of the factsheet.

What is CO?

CO is a colourless and odourless gas, making its presence difficult to detect. It is formed when domestic fuels such as gas, coal, wood and charcoal are burned and by petrol engines. When fuel burns in an enclosed room, the oxygen in the room is gradually used up and replaced with carbon dioxide. If carbon dioxide builds up in the air, the fuel is prevented from burning fully and starts releasing carbon monoxide instead.

How is CO poisoning caused?

CO is so dangerous because it binds very tightly to **haemoglobin** in the red blood cells and so reduces the amount of oxygen which can be carried in the bloodstream. Haemoglobin is the molecule in the blood that oxygen binds to in order to be carried around the body. The binding of CO to haemoglobin is actually more than 200 times stronger than for oxygen, so the CO effectively takes up all the space on the haemoglobin. In addition, CO interferes with the delivery of oxygen from haemoglobin into the body tissues.

These effects severely reduce the oxygen carrying capacity of the blood and limit the availability of oxygen to the body, with the brain and heart being particularly vulnerable. This can lead to anoxic brain injury. Pregnant women and the foetus are particularly susceptible to the toxic effects of CO.

factsheet

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Symptoms of CO poisoning

In acute CO poisoning (rapid onset, with short-term exposure), the symptoms will depend on the degree of exposure:

Mild

Headache, nausea and vomiting are the features of mild CO exposure, often along with a general feeling of malaise. These non-specific symptoms may be misdiagnosed as more common illnesses, such as flu, gastroenteritis or food poisoning. This may lead to CO poisoning being overlooked initially, unless there is a clear history of exposure.

Moderate

As the degree of CO poisoning becomes more marked, there may be a generalised feeling of weakness, with dizziness, unsteadiness and problems with concentration and thinking. More obvious changes in behaviour, confusion and drowsiness develop and there may be shortness of breath and chest pains.

Severe

In severe CO exposure, serious deterioration can occur quite quickly, with seizures, coma and death. MRI scans may show changes in the **basal ganglia** and the **white matter**.

Long-term effects of CO poisoning

Like other types of anoxic brain injury, acute CO poisoning may lead to quite severe long-term neurological problems, with disturbances in memory, language, cognition, mood and behaviour. The damage to the basal ganglia, which is a particular feature of CO poisoning, may lead to a movement disorder resembling Parkinson's disease.

An unusual feature of acute CO poisoning is the delayed deterioration in neurological condition which may be seen in some cases, occurring anything from a few days to as long as five to six weeks after the initial exposure. The reason for this is not entirely clear, but changes in the white matter seem to be involved. It has been suggested that these may result from **demyelination**, in which there is loss of the fatty, insulating myelin sheath of the **nerve axons**, therefore impairing their ability to conduct electrical nerve impulses.

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Chronic CO exposure

Chronic (persistent and long-term) exposure to lower levels of CO, as can occur with faulty domestic boilers, may go unrecognised. The symptoms include milder versions of those seen in acute CO poisoning, with headache, nausea, dizziness, light-headedness, fatigue and sleepiness, difficulty concentrating and memory problems, as well as changes in mood.

People may be aware that something is wrong, but be unable to identify exactly what is the matter, or may attribute the problems to overwork, stress or depression. If symptoms disappear while away at work, reappearing on returning home, or if other people in the same premises develop similar symptoms, it may become more obvious that there is an environmental cause.

Although most people seem to recover following chronic low level CO exposure when the source is removed, it can lead to anoxic brain injury. There have been some documented cases of subtle **Magnetic Resonance Imaging (MRI)** abnormalities and long-term neuropsychological effects.

Treatment of CO poisoning

Treatment of acute exposure to CO involves immediate removal from the source of the poisoning and administration of 100% oxygen, together with general supportive medical care.

Hyperbaric oxygen therapy is sometimes advocated for severe cases of CO poisoning and involves giving pure oxygen at increased pressures in a hyperbaric chamber. It has been suggested that this may improve the long-term neurological outcome, although it remains controversial. Hyperbaric oxygen therapy is a specialised technique, which is only available in a few centres. It may also be associated with complications of its own and it is not used routinely.

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Prevention of CO poisoning

- Do not** use poorly maintained appliances that burn gas or other fossil fuels
- Do not** burn charcoal in an enclosed space
- Do not** operate petrol-powered engines indoors or in enclosed spaces
- Do not** install, convert or service fuel-burning appliances without proper expertise
- Do not** use gas appliances if they produce yellow flames and deposit soot on walls
- Do not** use unflued appliances in small closed-up rooms
- Do not** use gas cookers for heating rooms
- Do not** sleep in a bedroom with a paraffin heater or an unflued gas fire
- Do** employ a qualified, reputable and registered engineer for work on all fuel-burning appliances
- Do** employ a suitably qualified engineer, who is registered with the Gas Safe Register (formerly CORGI), for work on gas appliances
- Do** have fuel-burning appliances checked regularly by a qualified engineer
- Do** fit a carbon monoxide alarm that meets British or European Standards
- Do** make sure chimneys and flues are clean and not blocked
- Do** make sure that all rooms are well ventilated when an appliance is being used
- Do** fit an extractor fan in your kitchen

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Further resources

The Carbon Monoxide and Gas Safety Society
Web: www.co-gassafety.co.uk

Carbon Monoxide Kills
www.carbonmonoxidekills.com

Carbon Monoxide Survivor
www.carbon-monoxide-survivor.com

CO Awareness
Web: www.co-awareness.org

Committee on the Medical Effects of Air Pollutants (COMEAP)
<http://www.dh.gov.uk/ab/comeap/index.htm>

Department of Health
Indoor air pollution – Carbon monoxide: Risks to health and how to reduce them
http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4123788.pdf

Gas Safe Register
Web: www.gassaferegister.co.uk

Health and Safety Executive *Gas safety – Carbon monoxide awareness*
Web: www.hse.gov.uk/gas/domestic/co.htm

Heating Equipment Testing and Approval Scheme (HETAS)
Web: www.hetas.co.uk

NHS Choices
<http://www.nhs.uk/Conditions/Carbon-monoxide-poisoning/Pages/Introduction.aspx?r=1&rtitle=Carbon+monoxide+poisoning+-+Introduction>

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To discuss any issues raised in this factsheet, or to find details of our local Groups and Branches, please contact the Headway freephone helpline on 0808 800 2244, or by email at helpline@headway.org.uk. You can also find more information and contact details of Groups and Branches on our website at www.headway.org.uk.

Headway produces a range of booklets and factsheets covering brain injury related issues. Booklets cost £3.50 each and can be ordered from the website, or on 0115 924 0800. a selection of recommended books are also available to order. Factsheets are freely downloadable from the website.

Brain injury survivors and carers can receive free copies of appropriate booklets from the helpline.

For definitions of the technical terms appearing in bold type, see the 'Common brain injury terms' section of the website at www.headway.org.uk/common-brain-injury-terms.aspx.

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