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Dear Colleague

CARBON MONOXIDE

1. It was recently Carbon Monoxide Awareness week in Scotland and in support of this, we are minded to write out to you, to be alert to the symptoms and signs of this preventable cause of death.

2. Early symptoms of carbon monoxide poisoning are often mistaken for mild 'flu like' illnesses or food poisoning. In Scotland between 2009 and 2011 there were 122 patients who had an episode of 'Toxic Effect of Carbon Monoxide' recorded at a hospital episode. This information does not reflect the severity of symptoms, does not indicate numbers of patients treated in A&E and discharged or those managed in primary care. There may be still more patients who are affected by chronic exposure to carbon monoxide and who have not sought medical help.

3. Carbon monoxide is a colourless gas with no smell or taste. The gas can be released from poorly maintained, poorly ventilated or incorrectly fitted fossil fuel burning cookers, boilers or fires. I urge you to be alert to the symptoms and signs. Further information and resources are provided below this letter (at Annex A).

Diagnosis:

4. Early symptoms:

- Headache
- Nausea
- Poor concentration
- Subjective weakness

Later symptoms:

- Appearance of intoxication or memory change
- Impaired mini mental state
- Vertigo and ataxia
- Breathlessness and tachycardia
- Chest Pain (caused by MI/angina)

From the Chief Medical Officer
Chief Nursing Officer
Chief Pharmaceutical Officer
Sir Harry Burns MPH
FRCS(Glas) FRCP(Ed) FFPH
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For action

NHS Board Chief Executives
NHS Board Immunisation Co-ordinators
NHS Board Medical Directors
NHS Board Nursing Directors
NHS Board Directors of Public Health
Infectious Disease Consultants
Practice Nurses
Health Visitors
CPHMs
Scottish Prison Service
Scottish Ambulance Service

For information

NHS Board Chairs
General Practitioners
Directors of Pharmacy
Consultant Paediatricians
Consultant Physicians
Health Protection Scotland
Chief Executive, NHS Health Scotland
NHS 24
Scottish General Practitioners
Committee

Further Enquiries

Policy Issues

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Medical Issues

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- Loss of Consciousness
- Seizures
- Abnormal Neurological signs

5. Additional factors to be alert to are the presence of symptoms in other members of the household and the gradual improvement of symptoms when away from the source.

Management:

6. Any patient (and others) suspected of being exposed to carbon monoxide should be removed from the source, fuel burning appliances turned off and rooms well ventilated.

People affected by high level exposures should be admitted for urgent hospital treatment. Patients who are exposed to low level carbon monoxide should generally managed in primary care, with the exception of pregnant women who are advised to undergo assessment in hospital. In addition, those with pre-existing cardiac or respiratory conditions, anaemia and children and the elderly may benefit from assessment in hospital. Detailed advice on investigations for CO poisoning can be obtained through TOXBASE or the National Poisons Information Service. You can follow advice on TOXBASE (www.toxbase.org) or refer to the National Poisons Information Service (NPIS) on 0844 892 0111 for more detailed advice on the management of CO poisoning and interpretation of blood sample results.

Prevention:

7. Scottish Government emphasise the importance of preventing deaths from accidental carbon monoxide poisoning by being aware of the symptoms. The public should be reminded to ensure **fuel burning appliances are fitted and maintained by a regulated professional and be advised to install carbon monoxide detector alarms**. New regulation requires that carbon monoxide alarms are fitted next to recently installed fuel burning appliances. Whilst the regulation does not apply to existing fuel burning appliances, these households are strongly encouraged to fit carbon monoxide detectors to save lives. CO Alarms should have the EN50291 standard and be tested regularly.

8. We urge you to be aware of symptoms and signs of carbon monoxide poisoning and help Scotland to reduce these avoidable deaths. Thank you for your continued support in this regard.

Yours sincerely

Harry Burns

Ros Moore

Alpana Mair

HARRY BURNS

ROS MOORE

ALPANA MAIR

Mechanisms of action of carbon monoxide

Carbon monoxide enters the blood via the lungs. Inhaled CO combines with hemoglobin to form carboxyhemoglobin (COHb). Once this occurs, the capacity of hemoglobin to carry oxygen is much reduced. Carbon monoxide binds to haemoglobin with about 240 times the affinity of oxygen and causes a left shift in the oxyhaemoglobin dissociation curve. These effects combine to reduce oxygen delivery to the tissues.

In addition, carbon monoxide is transported dissolved in plasma and binds to intracellular myoglobin and mitochondrial cytochrome enzymes. Recent studies have shown that carbon monoxide may function as a local transmitter substance in the body playing a role in controlling permeability of the micro-vasculature and may increase adhesion of inflammatory cells and platelets to the capillary endothelium. Carbon monoxide poisoning leads to leakage of fluid across cerebral capillaries and thus to cerebral oedema. In those who have been exposed to enough carbon monoxide to produce unconsciousness, delayed neurological damage due to leuko-encephalopathy may occur. Damage tends to be focused on those parts of the brain lying at the boundaries of the fields supplied by 2 cerebral arterial systems, e.g. the basal ganglia. Neurological damage seems to be the result of free radical generation and lipid peroxidation. It is possible that the binding of carbon monoxide to cytochrome A3 reduces the capacity of cells to deal with free radicals.

Carbon monoxide bound to haemoglobin has a half life of about 320 minutes under normal circumstances. This can be reduced by exposing the patient to 100% oxygen: this reduces the half-life to 80 minutes; or to 100% oxygen at 2 atmospheres pressure (hyperbaric oxygen) which reduces the half-life to 23 minutes. The half life of carbon monoxide bound to mitochondrial cytochromes may well be much longer than that of carboxyhaemoglobin and hyperbaric oxygen has been suggested as being important in attacking this binding site. Carbon monoxide binds to fetal haemoglobin and shifts the already left-shifted fetal oxyhaemoglobin dissociation curve further to the left. The half life of CO in the fetus is longer than that in the mother.

Further information for patients:

Gas safety information: <http://www.hse.gov.uk/gas/domestic/co.htm>

To find a registered gas engineer: <http://www.gassaferegister.co.uk/> or free phone: 0800 408 5500

For a patient factsheet:

<http://www.documents.hps.scot.nhs.uk/environmental/sg-co-awareness-factsheet.pdf>

For information regarding CO-Awareness please see: <http://www.covictim.org/>

Information on Getting Ready for Winter: <http://www.readyscotland.org/>

Further information for professionals:

A Clinical Knowledge Summary is available at:

<http://cks.nice.org.uk/carbon-monoxide-poisoning#!topicsummary>

Additional information may be found on the HPA website:

<http://www.hpa.org.uk/web/HPAweb&Page&HPAwebAutoListName/Page/1226908886240>

TOXBASE: www.toxbase.org

National Poisons Information Service: 0844 8920111