

IRISH ASSOCIATION FOR
EMERGENCY
MEDICINE



IAEM Clinical Guideline

Acute Carbon Monoxide Poisoning

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DISCLAIMER

IAEM recognises that patients, their situations, Emergency Departments and staff all vary. These guidelines cannot cover all clinical scenarios. The ultimate responsibility for the interpretation and application of these guidelines, the use of current information and a patient's overall care and wellbeing resides with the treating clinician.

| Revision History | Section | Summary of Changes | Author |
|-------------------------|----------------|---------------------------|---------------|
| Final version V1.0 | All | | |

CONTENTS

| | |
|---|----|
| GLOSSARY OF TERMS | 4 |
| INTRODUCTION | 5 |
| PARAMETERS | 6 |
| AIMS | 6 |
| CLINICAL FEATURES | 7 |
| Table 1: Clinical Features of CO poisoning..... | 7 |
| INVESTIGATIONS | 7 |
| Table 2: Other investigations considered in CO poisoning..... | 7 |
| MANAGEMENT | 8 |
| SPECIAL CONSIDERATIONS | 9 |
| OTHER RESOURCES | 9 |
| REFERENCES | 10 |

GLOSSARY OF TERMS

| | |
|------------------|-----------------------------|
| CK | Creatinine Kinase |
| CO | Carbon Monoxide |
| COHb | Carboxy-haemoglobin |
| ECG | Electrocardiogram |
| ED | Emergency Department |
| FiO ₂ | Fraction of Inspired Oxygen |
| GCS | Glasgow Coma Scale |
| LOC | Loss of Consciousness |
| O ₂ | Oxygen |

Acute Carbon Monoxide Poisoning

INTRODUCTION

Carbon Monoxide poisoning is the most common human poisoning. CO is formed by incomplete combustion. Smoke inhalation from fires, motor vehicle exhausts and other engine exhausts are the most prevalent sources of exposure.

Approximately 1% to 3% of all poisonings are fatal.¹ Those at highest risk of mortality are:

- Older patients (with fire as source of CO)
- Patients with very elevated COHb levels and respiratory failure
- Patients who experience loss of consciousness

Diagnosis is based on the clinical **triad** of:

- History of CO exposure,
- Elevated COHb levels, AND
- Symptoms consistent with CO poisoning.

PARAMETERS

| | |
|--------------------|---|
| Target audience | Medical professionals working in Emergency Departments. |
| Patient population | Patients >18 years of age presenting with acute CO poisoning, diagnosed or suspected. |
| Exclusion criteria | Pregnant patients and foetal exposures. Chronic CO poisoning. |

AIMS

The aim of this document is to provide guidance to clinical staff involved in the first line assessment and management of adults presenting to the ED with suspected or diagnosed acute CO poisoning.

CLINICAL FEATURES

Clinical features vary from mild and non-specific through to life threatening (Table 1).

| | Symptoms and signs |
|----------------|---|
| General | Headache (90%), nausea, vomiting, weakness |
| Neurological | Dizziness, confusion, ataxia, seizures, coma |
| Cardiovascular | Sinus tachycardia, arrhythmias, myocardial infarction, pulmonary oedema |

Table 1: Clinical Features of CO poisoning

INVESTIGATIONS

Patients with suspected exposure to CO should have their COHb level measured. The gold standard test is laboratory blood gas CO-oximetry².

This can be drawn from venous blood.

- Levels >3% are abnormal in non-smokers
- Levels >10% are abnormal in smokers
- Severe poisoning occurs at 30%

Other investigations can be considered to identify complications of CO poisoning (Table 2)

| INVESTIGATIONS | TO RULE OUT |
|--|---------------------------|
| ECG / Troponin | Myocardial infarction |
| Renal function tests, Liver function tests | Renal/Liver impairment |
| CT Brain / MRI Brain | Cerebral ischaemic insult |
| CK | Rhabdomyolysis |
| Blood Glucose level | Hyperglycaemia |

Table 2: Other investigations considered in CO poisoning

MANAGEMENT

- Supportive care: patients with altered GCS or cardiovascular instability should be managed in a resuscitation area with full monitoring.
- Provision of high concentration O₂ as quickly as possible is the mainstay of treatment. For non-intubated patients, O₂ should be provided at 15L/minute via a tight fitting non-rebreather mask with reservoir bag. Consider high flow nasal oxygenation to administer 100% O₂ at 50-60L/min if available. Intubated patients should have FiO₂ of 1.0.³ The endpoint of O₂ therapy remains poorly defined. Duration of O₂ therapy should be at least 6 hours. COHb level should be <5% and patient should be asymptomatic prior to cessation of O₂ therapy in the ED.
- Hyperbaric O₂ therapy: Evidence for the use of hyperbaric O₂ therapy in CO poisoning remains uncertain. It should be considered, in consultation with a clinical toxicologist, in patients with the following:
 - Loss of consciousness
 - Ischaemic cardiac changes
 - Neurologic deficits
 - Significant metabolic acidosis
 - COHb levels >25%

The National Hyperbaric Medicine Unit is located at University Hospital Galway. For emergencies, contact the **University Hospital Galway switchboard at 091-524222** and ask for the third on-call anaesthetist.

- Consider cyanide poisoning in any patient who has been exposed to smoke inhalation.
- Hyperglycaemia, if present, should be treated with insulin, as neurological outcomes following CO poisoning may be worse in patients with hyperglycaemia.

SPECIAL CONSIDERATIONS

Survivors of CO poisoning have a higher long-term mortality rate than their non-poisoned counterparts, and 15% to 40% suffer from near-permanent neurocognitive sequelae.^{3,4} These patients require specialist follow-up.

OTHER RESOURCES

- Toxbase - The primary clinical toxicology database of the National Poisons Information Service, available at <https://www.toxbase.org>
- National Poisons Information Centre at Beaumont Hospital, Dublin 9 at 01-809 2566 or 01-837 9964 (24 hours)

REFERENCES

1. Rose JJ, Wang L, Xu Q, et al. Carbon monoxide poisoning: pathogenesis, management, and future directions of therapy. *Am J Respir Crit Care Med*. 2017 Mar 1;195(5):596-606.
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3. https://www.austin.org.au/Assets/Files/Carbon%20Monoxide_SG.pdf
4. <https://bestpractice.bmj.com/topics/en-us/432>