Carbon Monoxide Intoxication – underrecognised but deadly

L'intoxication au monoxyde de carbone: une affection mortelle trop souvent méconnue Koolstofmonoxidevergiftiging: vaak miskend en levensgevaarlijk

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Introduction - disclaimer

- Hyperbaric Oxygen Treatment centre
- Transfer for patients based on
 - Algorhitm for CO intoxication (www.achobel.be)
 - Availability of hyperbaric chamber
- Interests:
 - Minimise delays before definitive treatment
 - Optimise first aid



Overview

- How big is the problem ?
- Why is it under-recognised ?
 - Lack of knowledge of physics
 - Wrong assumptions (social context)
 - Interpretation of symptoms physiopathology
- Why is it a serious health risk ?
 - Death
 - Overtreatment
 - Undertreatment / prevention

How big is the problem ?

- Epidemiological data sources
- Register for Carbon Monoxide, Annual Report(s)



- European Registries
- Uncertainties
 - Definition of CO intoxication (ICD classification)
 - Underreporting ?
 - Chronic intoxication (almost) never reported
 - Sequelae vague, variable, not systematically reported

Epidemiology (courtesy: Dr M. Fortuyn, Poison Centre) Annually: between 1200-1400 victims hospitalised Some (many ?) not registered ? 30-40 people killed (0.27-0.36/100,000) (slowly) downward trend (prevention ?) Age of victims - young and old similar Approximately 55% of cases reported from hospitals with Centres for Hyperbaric Oxygen (hyperbaric or normobaric oxygen)















Causes of carbon monoxide production

- Insufficient oxygen to flame
 - Pipes apparatus
 - Environment
- Insufficient exhaust gas evacuation
 - Pipes Environment
- Chemical reactions (PM)











Hyperacute intoxication = blood (haemoglobin) intoxication

- Minor levels are not always symptomatic
- Hypoxemia possibly lethal when > 60% blocked



Longer intoxication = tissue intoxication

- Cellular intoxication SLOW
 - CO binds to energy producing enzymes in cell
 - Myoglobin (heart, muscle) Cytochrome c,c3 (respiratory chain mitochondria)
 - Estimated 15-45% of all CO in the body is thus "fixed" in tissues
 - Depends on level and duration of intoxication
 - · Can not be measured directly
 - Brain, heart = most vulnerable





CO (ppm)	% CO in air	Symptoms
100	0.01	No symptoms
200	0.02	Mild headache, few other symptoms
400	0.04	Headache after 1-2 hours
800	0.08	Headache after 45 minutes, nausea, collapse, and unconsciousness after 2 hours
1.000	0.10	Dangerous, unconsciousness after 1 hour
1.600	0.16	Headache, dizziness, nausea after 20 min.
3.200	0.32	Headache, dizziness, nausea after 5 min., unconsciousness after 30 minutes
6.400	0.64	Headache, dizziness after 1-2 minutes, unconsciousness after 10-15 minutes
12.800	1.28	Immediate unconsciousness, danger of death in 1 to 3 minutes

Recognizing CO intoxication

- Symptoms
 - Headache, nausea, weakness, vertigo
 - Cardiac complaints (angina pectoris)
 - Decreased consciousness (stuporous, coma)
 Sudden loss of consciousness (bathroom)
- Circumstances Environment !
 - Combustion device present
 - Duration of exposure !
 - Meteorological
- Multiple persons Pet animals !

Recognizing CO intoxication

- Emergency Medical Services
 - CO detector in air
 - SaCO measurementCarboxyhemoglobin measurement in (venous) blood
- Beware: LOW Carboxyhemoglobin is NOT EQUAL to minor intoxication !!
 - Tissue vs Blood intoxication
 - Persons at risk: elderly, cardiac, young children...
 - Duration of intoxication
- Chronic intoxication : UNDERDIAGNOSED

Treatment of CO intoxication

- Antidote = oxygen
- 100% O₂ needed
 - Rapid elimination of CO from COHb resume O2 transport
 CPR BLS/ALS with high flow oxygen
 - 100% in non-rebreathing mask (types of mask !!)
 - Duration: needs to desintoxicate the brain ! • 6-12 Hrs = in function of duration and CO level !



Do all CO-intoxications need Hyperbaric Oxygen therapy ?

- Only Tissue Intoxications REALLY benefit from HBO
 - Tissue oxygenation independent of oxygen-carrying capacity of Haemoglobin
 Prain (cardiac re ovygenation almost instantly)
 - Brain/cardiac re-oxygenation almost instantly
- Indication for HBO (virtually) INDEPENDENT from carboxyhemoglobin level !



Recommended reading

- Poison centre website (www.poisoncentre.be) • Overview of CO-intoxication
 - HALLOWEEN folder downloadable
- ACHOBEL website (www.achobel.be)
 - CO Intoxication Evaluation and Treatment Algorhitm
 - Information about Hyperbaric Oxygen Therapy
 - Contact information HBO Centres Belgium/Luxemburg/ Europe
- Many local initiatives prevention educative websites – knowledge = safety