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### Carbon Monoxide Poisoning

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# Carbon Monoxide Poisoning

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## Topic

- Carbon Monoxide Poisoning
- Body's inability to utilize inhaled oxygen in an appropriate manner. Leading to low oxygen saturation and respiratory failure (Megas et al., 2021).

## Why Carbon Monoxide Poisoning?

- Responsible for 40-50 thousand Emergency Department admissions per year (CDC, n.d.)
- More than 400 Americans die annually (CDC, n.d.)
- Everyone is at risk
- Most common cause of fatal intoxication (Neilseni et al., 2019).

## Signs & Symptoms

- Clinical symptoms vary based on length and severity of exposure to gas.
- Headache, dizziness, nausea, and vomiting
  - Confusion, concentration deficit, irritability, lethargy
  - Delayed neurological sequelae
  - Coma, death
  - Elevated carboxy hgb levels
- (Longhitano et al., 2019)

## Pathophysiology

Carbon monoxide is a colorless, odorless gas released from heating systems, water heaters, vehicle emissions, and fires (Onodera et al., 2021).

- Produced by incomplete combustion of organic compounds
  - Inhaled into the lungs and into the blood stream
  - 240 times greater affinity for hemoglobin than oxygen causing an impaired utilization of oxygen since there is nowhere to bind, hypoxia
  - High affinity for myoglobin and cytochrome oxidase causing dysfunctional tissue oxygen transport, cardiac dysfunction, impaired neurological function
  - Leads effected cells to undergo apoptosis, programming cells for death releasing cytoplasmic granules and intracellular toxic stress
  - Vascular permeability potentiation, causing an accumulation of interstitial fluid and decreases circulating blood volumes
- (Bedair et al., 2020)

## CARBON MONOXIDE (CO) POISONING



## Clinical Significance

- Wide range of clinical manifestations
- Delayed onset of neurologic injury
- Treatment costs estimate 1.3 billion dollars per year (Eichhorn et al., 2018).

## Nursing Care

- Critical thinking
- Ability to manage non invasive respiratory devices (CPAP, BiPAP, High flow Nasal Cannula)
- Ability to assist in invasive airway procedure, endotracheal tube insertion
- Diuretic administration to relieve interstitial fluid
- Head to toe assessment with enhanced neuro exam to identify neurological deficits
- Proficient in ABG analysis
- ECG interpretation to identify cardiac dysfunction due to hypoxia

(Eichhorn et al., 2018)

Picture below (Healthy Children, 2021).

## Risk Factors

- Gas powered appliance leak
- Poor ventilation of garage with vehicle emissions
- Cigarette smoking
- Fires
- Low income households with alternate heating sources
- People with anemia and existing hypoxemia ( People with reduced hemoglobin will have an exacerbated effect of hypoxia (Megas et al., 2021)

## Treatments

- Hyperbaric Oxygen Therapy increases the absorption of oxygen in the body, causing a concentration gradient to release carbon monoxide from hemoglobin molecule, allowing oxygen to bind
- Non-invasive ventilation
- Fluids to clear lactate levels from anaerobic metabolism
- Early intervention to assess for neurological impairment
- MRI to identify brain lesions

(Christiansen, 2020)

The below picture displays a graphic representation of a hyperbaric oxygen chamber along with some pretreatment instructions (Verywell Health, n.d.).



## Complications

CO poisoning can potentiate a plethora of post exposure complications

- Hypoxia
- Cardiogenic Shock
- Neurologic lesions
- Delayed Encephalopathy
- Respiratory Failure
- Blood Clotting
- Brain Ischemia

(Rose et al., 2017)

The below picture illustrates demyelinating lesions identified in a delayed neurological injury caused by carbon monoxide poisoning (Onder & Kilicaslan, 2021).

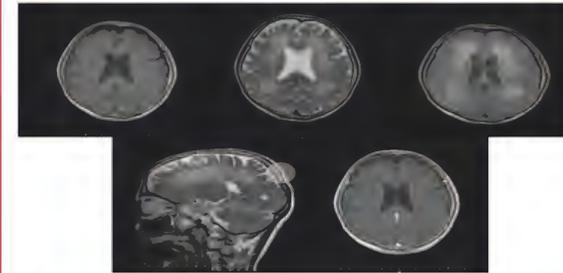


Figure 1. Diffuse demyelinating lesions without contrast enhancement at periventricular white matter and centrum semiovale mildly hypointense in the T1W sequence and hyperintense in T2W and FLAIR sequences.

## Case Study

57 year old male admitted to ER for acute carbon monoxide poisoning. And cardiac depression. Treated with hyperbaric oxygen therapy, correction of myocardial injury, and discharged home without proper identification of environmental source of CO poisoning. Patient was readmitted three days later due to continuous exposure and died as a result (Longhitano et al., 2019).

## Conclusions

- Everyone is at risk for CO poisoning
  - CO poisoning is attributed to delayed onset of neurological injuries which may not be easily identified before the damage has taken place
  - CO poisoning can be difficult to diagnose due to vague symptoms
  - Exposure might go unnoticed since gas is colorless, and odorless
  - Careful assessment of home environment for contributing source is key to making sure it does not happen again
- (Wu et al., 2020)

## References

