A review: On Carbon Monoxide Poisoning

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Abstract:

Carbon Monoxide is the tasteless, odourless, colourless gas produced by incomplete combustion of organic material. CO poisoning is the most common form of unintentional poisoning. CO decreases the amount of oxygen in blood. Co has more tendency to bind with the haemoglobin of blood instead of oxygen. CO is dangerous for peoples work in CO affected area and people sleeping in close room with burning heater. The fatality is depend on the concentration of CO in the environment. A number of individuals dying of Co poisoning over the world. The manner of death could be accidental, suicidal and homicidal. The most affected areas are heart and brain. CO stops respiration and circulation centres. In forensics it will help to determine the manner of death. So CO need to be analyser and identified from human samples. Therefore an attempt has been made to describe about carbon monoxide poisoning and various diagnostic & identification methods and various forensic significance in the forensic science.

Introduction:

Carbon Monoxide- Carbon Monoxide is the tasteless, odourless, colourless and non-irritating gas produced by incomplete combustion of organic materials. It is also produced in man due to the catabolism of haemoglobin. It is toxic to haemoglobin animals when encountered in concentration above about 35ppm, although it is also produced in animal metabolism in low quantities and is thought to have same normal biological functions. In atmosphere it is spatially variable and short lived, having a role in the formation of ground level ozone.

Carbon Monoxide consists of one carbon atom and one oxygen atom connected by a triple bond that consists of two covalent bonds.

Sources of Carbon Monoxide:

Carbon monoxide originates from incomplete combustion of carbonaceous matter in automobiles engines and defective furnaces, incomplete combustion of agricultural and slash matter and also by the interaction of carbon dioxide with the coke at high temperature in industrial furnaces such as blast furnaces. Some natural processes such as forest fires, volcanic activity, seed germination, lightning discharge during thunder storms etc., also release carbon monoxide in small amounts.

Major proportion of gas is, of course contributed by human activity. Thus, of the amount of CO present in the atmosphere is about 73 percent is contributed by vehicular exhausts and about 17 percent by forest fires and agricultural and slash burning. The contribution by natural phenomena is thus very small.

Carbon Monoxide Poisoning:

Carbon monoxide poisoning is the most common form of unintentional poisoning. CO is readily absorbed across the alveolus and combines with haemoglobin.CO induces toxic effects by tightly binding to haemoglobin to form carboxyhaemoglobin i.e. COHb and reducing the oxygen carrying capacity to red blood cells. CO affinity to myoglobin is 40 times greater than oxygen, which may cause direct myocardial depression. It also interferes with cellular respiration by binding to mitochondrial cytochrome oxidase. It acts as a chemical asphyxiant and produces death due to anaemic anoxia. The presence of COHb in the circulation alters the oxygen affinity of the haemoglobin, decreasing the release of oxygen into the tissues.

Sign and Symptoms:

The brain and heart is most affected organ in CO poisoning because they extract the greatest percentage of oxygen. The symptoms are developed progressively with the rise of CO in blood and regression depends upon the clearance of CO from blood. Possible symptoms shows by the person are headache, fatigue, nausea, dizziness, disorientation, unconsciousness etc. With the increase in the concentration of CO in blood the symptoms changes from mild to severe.

For instance at 30-40%: Severe headache, nausea, vomiting, confusion, cherry red colour.

At 50-60%: Coma with intermittent convulsions, rapid respiration, pink or red discolouration of the skin.

AT 70-80%: Profound coma with depressed or absent reflexes shallow and irregular respiration and death.

The rate of CO combining with haemoglobin depends on the atmospheric concentration and rate of respiratory exchange.

Forensic aspect of CO poisoning:

Carbon Monoxide poisoning is mostly seen in suicidal and accidental cases and rarely seen in homicidal cases. According to research in India suicide by CO poisoning is very rare, accidents may take place due to the exposure to exhaust gas of petrol engine, exposure to gas in mines following underground fires or explosions and exposure to gas during fires. Mostly the accident happens during winters due to the burning of charcoal. Homicide is uncommon unless the victims are adults incapacitated by drink, drugs, disease or infirmity or they are children.

Post mortem appearance shows the presence of CO in the body. A cherry red colouration of the skin, mucous membrane, nail-beds can be seen. There may be blistering of the skin of dependent areas, such as buttocks, calves, wrists and knees due to cutaneous oedema. The lungs may show bronchopneumonic consolidation. Myocardial infarction has been reported after severe exposure and relative hypoxia, usually in the presence of pre-existing coronary disease.

Thus, CO poisoning helps to determine the manner of the death i.e. suicidal, homicidal, and accidental.

Methods and Materials:

Collection of Blood: If vapour or gas intoxication is suspected as the cause of death, 10 ml of heart blood should be collected prior to autopsy. CO-blood has very little tendency to clot. The cells tend to separate from the plasma in the blood vessels and organs of the body. Since CO is contained in the cells, care should be taken to removing the sample of blood. If the blood is taken from the heart, this may be done may be done by filling the syringe and flushing it back into the heart, then refilling to take the sample. Fluoride should be added as preservative. It should be placed in a tightly sealed gas-tight container. The blood need not be

kept under a layer of liquid paraffin because the carboxyhaemoglobin molecule is extremely stable. If sufficient blood is cannot be obtained from the heart or major vessels, the spleen or muscle should be sent for analysis. Pieces of lungs should also be placed in suitable container tightly sealed and refrigerated. In badly burnt body CO can be detected in any sanguineous body fluid or bone marrow.

Tests for Diagnosis:

Kunkel's test – Also known as the Tannic acid test, if tannic acid is added to blood it remains cherry-red in CO poisoning, while oxyhaemoglobin turns deep brown.

Procedure:

A few drops of 3% tannic acid is added to patient's blood diluted 1:10 with distilled water; the appearance of a crimson red coagulum indicates the presence of Carboxyhaemoglobin.

Hoppe-Seyler's test:

Procedure: Few drops of blood are added to a solution of 10% of sodium hydroxide.

Result: Normal blood turns brownish-green, but if CO is present, the colour will remain pink.

Spectroscopic Examination:

This is a delicate chemical test for the detection of carboxyhaemoglobin. This test is more delicate than chemical test and serves to detect the presence of as low content as 5 % of CO haemoglobin. Spectroscopic examination of blood shows characteristic bands of carboxyhaemoglobin.

If only tissue is available, water is used to extract blood from liver, spleen, kidney, lungs, bone marrow, and other organs. CO persists for many weeks after death and may be detected even after putrefication or embalming and prolonged burial. It is preferable to use anticoagulant in specimens for examination.

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Conclusion: Acute carbon monoxide poisoning is very dangerous and can cause death. Based on the research it can be concluded that CO poisoning most commonly seen in accidental cases, sometimes in suicidal cases and most rarely in homicidal cases.

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