Cyanide Poisoning: Pathophysiology and Clinical Manifestation

PLAY PICMONIC

Pathophysiology

Inhibits Complex IV of Oxidative Phosphorylation

Ox-pi badge with four-fork inhibited by chains

The primary mechanism by which cyanide causes toxicity is by inhibiting complex four of oxidative phosphorylation, also called the elctron transport chain. Recall that this process takes place in the mitochondria, and is the stage in which the most ATP is produced during aerobic respiration.

Forces Cells Into Anaerobic Metabolism

Ant-robe

By inhibiting oxidative phosphorylation and thus eliminating aerobic metabolism as a source of ATP, cyanide prevents the cells from being able to use oxygen despite an ample supply, thus forcing the body's cells to switch to anaerobic metabolism, which produces far less ATP.

Presentation

Exposure to Fire Fumes

Fire-fumes

One of the most common causes of exposure to cyanide in industrialized countries is domestic fires. The combustion of various household products such as plastics, wool, silk, and polyurethane results in the production and release of cyanide.

Industrial Exposure

Industrial machine

Another common cause of cyanide toxicity is industrial exposure. Specifically, metal extraction in mining, electroplating used in photography, jewelry production, and plastics and rubber manufacturing have been implicated.

Headache and Confusion

Head-egg on confucius

The central nervous system is among the first systems affected by cyanide toxicity. Manifestations range from mild confusion and headache to loss of consciousness and seizure.

Arrhythmias

Broken Arrhythmia-drum

Cyanide poisoning can cause arrhythmias as a result of causing a functional hypoxia by blocking oxidative phosphorylation, thus preventing the body from using oxygen. The specific arrhythmias seen may vary, but pulsless electrical activity (PEA), ventricular tachycardia, and ventricular fibrillation may all be seen.

"Cherry Red" Skin

Skin-suit guy with cherries

One of the commonly heard buzzwords associated with cyanide poisoning is "cherry red skin". This results from high concentration of venous oxyhemoglobin as a result of the peripheral tissue's inability to utilize oxygen, causing the venous blood to appear a much brighter red.

Almond Breath/Taste

Almond breath

Patients who have acquired cyanide toxicity via an inhaled route may note a bitter almond taste, and they may be noted to have almond-scented breath.

Acute Renal Failure

Kidney

In some cases, renal failure may be seen as a result of cyanide toxicity. This is caused by the effects of nephrotoxic metabolites that accumulate as a result of the body's processing of cyanide.