Institutet för miljömedicin

Cyanide in breath as a marker for cyanide poisoning

AKADEMISK AVHANDLING
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ABSTRACT

Approximately 120 people die every year due to fires in Sweden. A majority of the fire victims die due to toxic fire gases. Carbon monoxide is often thought to be the major cause of death. Still, another very toxic fire gas, hydrogen cyanide, is formed when materials containing nitrogen burn, e.g. wool or polyurethane foam. The influence of cyanide to fire deaths is difficult to assess due to post mortem break down of cyanide.

Data on carboxyhemoglobin and blood cyanide from deceased fire victims during the period 1992-2009 were collected from two Swedish nationwide forensic databases (ToxBase and RättsBase) (Study IV). The analysis of these data supports the notion that hydrogen cyanide contributes more to the cause of death among fire victims than previously thought.

Cyanide poisoning can be treated with antidotes. Rapid initiation of the treatment is essential. However, no good rapid diagnostic method is currently available. To bridge this gap, we have investigated the possibility of using cyanide in breath as an indicator to cyanide poisoning. In Study I, a low concentration exposure to cyanide showed that the washout of cyanide is rapid. Extrapolating this to a high concentration exposure resulted in that exhaled air, a few minutes after exposure to cyanide, will represent the systemic concentration of cyanide.

In Study II background levels of cyanide in breath was measured in 40 volunteers. The levels ranged from <1.5-14 ppb. Previously published data on background levels of cyanide in breath range from 0 to 62 ppb. In Study III, a physiologically based toxicokinetic model was developed to estimate the levels in exhaled breath after a lethal/near-lethal exposure. The model indicated levels in the range of 0.2-1 ppm. Comparing these results gives more than a twofold difference between unexposed and exposed subject. Thus, indicating that the groups could be separated from one another.

Hence, measurement of exhaled air in fire victims can be used to indicate cyanide poisoning.